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Associative Responding, Problem Solving, and Motivation

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ASSOCIATIVE RESPONDING, PROBLEM SOLVING, AND MOTIVATION

by

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VITA

The author, Allan N. Kaczala, is the son of Norbert J. Kaczala (deceased) and Martha (Hencinski) Kaczala. He was born on July 11, 1945, in Chicago, Illinois.

From September, 1963 to June, 1965, he attended St. Mary of the Lake College in Chicago, Illinois. From September, 1965 to June, 1966 he attended St. Louis University. In September, 1966, he entered Loyola University of Chicago where he was awarded the degree of Bachelor of Science with a major in psychology in June, 1967. In September, 1967, he began his graduate studies in clinical psychology at Loyola. From October, 1968 to May, 1969, he served his clerkship at Hines V.A. Hospital. From September, 1969 to August, 1970, he served his internship at Rush-Presbyterian-St. Luke's Hospital. From September, 1970 to May, 1971, he served as teaching assistant to the Director of Clinical Training. From September, 1970 to the present, he has served another internship at the Loyola University Guidance Center. In February, 1972, he was awarded the degree of Master of Arts. The author has served as lecturer in psychology from September, 1972 to January, 1973.

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CHAPTER I

INTRODUCTION AND REVIEW OF LITERATURE

Nature of the Problem

Probably since schools were first established, educators have been interested in the question of why some children learn better or faster than others. Before the turn of the century, educators and philosophers were largely confined to observing and speculating about individual differences in the scholastic attainments of children. Since the early 1900's, however, psychologists and educators have devoted considerable energy to the scientific study of these individual differences. One of the legacies of this line of research has been the consistent finding that intellectual ability as measured by IQ tests accounts for a substantial amount of these individual differences. Most research indicates that IQ accounts for about 50 per cent of the individual differences in the scholastic attainments of children in elementary school (Cronbach, 1970). In order to better predict scholastic achievements and to understand which factors other than IQ contribute to individual differences in school performance or to underachievement, researchers have studied such factors as the

child's need to achieve, his anxiety over taking tests, his personality characteristics, his concept of himself as a person and as a student, and his self esteem.

While the line of research which has investigated individual differences in school performance has a rather long history, during the early 1950's another independent line of research began with the work of Witkin and his associates on field independence — field dependence (Witkin, Lewis, Hertzman, Machover, Meissner, & Wapner, 1954) and the work of Gardner and his associates on cognitive controls (Gardner, 1953; Gardner, Holzman, Klein, Linton, & Spence, 1959). This more recent line of research, the investigation of cognitive styles, has primarily focused on qualitative differences in perceptual and cognitive processes. Kogan (1971) defined cognitive styles as "distinctive ways of apprehending, storing, transforming, and utilizing information [p. 244]." Cognitive styles are distinct from ability in that ability primarily relates to "the level of skill — the more and less of performance — whereas cognitive styles give greater weight to the manner and form of cognition [Kogan, 1971, p. 244]." While the research on cognitive styles initially was not concerned with the relationship between children's cognitive styles and their school performance, recently some researchers have moved in this direction, i.e., Kagan and his associates (Kagan, 1965; Yando & Kagan, 1968).

The present research was designed to study one type of cognitive style, associative responding, which has been found to be related to school performance. Associative responding refers to the relative tendency to solve problems by free association rather than by reasoning through the problem. Achenbach (1969, 1970a, 1970b, 1971) has consistently found that the correlations between ability (IQ or Mental Age) and performance (school grades and scores on standardized achievement tests) are substantially lower for children who respond associatively rather than reasoning through the problem. In view of these findings, Achenbach has concluded that the child who responds associatively does not seem to be fully utilizing his ability. There has been very little research on the determinants of associative responding; however, Achenbach (1969; Kerner & Achenbach, 1971) has offered two general ideas to account for it. The first general idea focuses on cognitive factors. It suggests that associative and relational children use different strategies in problem solving and approaching school work and that the associative child's strategy is less adaptive for school. Too little research has been done to speculate on the further question of the relative extent genetic and learning factors may contribute to the style of responding associatively. The second general idea, which does not conflict with the first, focuses on dynamic or motivational factors. It suggests that responding associatively may be

the consequence of excessive failure experiences.

The present investigation was designed to examine the relative extent cognitive and motivational factors are associated with responding associatively. More specifically, this study was designed to examine the performance of associative and relational children on tasks associated with problem solving which bears on the cognitively focused notion. In addition, this study was planned to examine possible differences between associative and relational children in motivational factors which seem to be associated with experiences of failure. This second goal bears on the motivationally based explanation of associative responding.

Finally, this study was undertaken for several other reasons. First, it seems that a style of responding associatively is associated with or interferes with the effective use of one's abilities in school which is likely to lead to the waste of talent and possibly personal unhappiness. Second, it may be argued that one of the primary values of many psychologists and humanists is that everyone have the opportunity to grow and develop to the fullness of their potential and that associative responding may be related to the hindering of this process. Third, the investigation of associative responding has practical consequences in terms of educational planning. When the determinants of associative responding have been identified,

experimentation might begin to evaluate procedures for the modification of the associative responding style or for the amelioration of the negative effects of this style. With regard to the former, if associative responding represents an ineffective habit or skill deficit, behavior modification procedures would seem to be the method of choice for modifying this behavior. If associative responding is more strongly associated with dynamic or motivational factors, counseling might be indicated. With regard to amelioration of the effects of associative responding on school performance, one might speculate that associative children perform relatively poorly in school because their cognitive style is not suited to current teaching methods. Hence, one might further speculate that associative children might perform better in learning situations tailored to their style of problem solving.

Development and Measurement of the Concept

The research on associative responding developed from a series of studies on outer-directedness in retarded individuals (Saunders, Zigler, & Butterfield, 1968; Turnure & Zigler, 1964). Initially Achenbach did research on outer-directedness in retardates (Achenbach & Zigler, 1968), and subsequently became interested in its analogue in normal children (Achenbach, 1969). Associative responding and outer-directedness have been defined in identical terms. Associative responding (or outer-directedness or a cue

learning strategy) was defined by Achenbach (1969) as "problem solving behavior characterized by a reliance on concrete situational cues, such that overt behavior is guided by the cues with little attempt being made to educe abstract relationships among problem elements [p. 717]." Non-associative responding (or inner-directedness or a problem-learning strategy) was defined by Achenbach (1969) as "problem solving behavior characterized by active attempts to educe abstract relations among problem elements in order to proceed from these relations to the solution of the problem [p. 717]."

In order to assess the relative tendency to respond associatively rather than relationally, Achenbach (1969) devised a multiple-choice analogies test, the Children's Associative Responding Test (CART). Half of the items on the CART have an incorrect alternative ("foil") which, for children in grades 5 through 8, is a frequent association to the third word of the analogy. For example, in the analogy, "Pig is to boar as dog is to ?", "cat," a frequent association to "dog," appears as one of the four incorrect alternatives, while "wolf," an infrequent association, is the correct alternative. The other half of the items are straight analogies, i.e., contain no foil items. Achenbach has been primarily interested in studying cognitive style variables rather than in refining analogy items. Hence, the score of primary interest has been the

difference between the number of foil errors which are assumed to be due to incorrect analogical reasoning as well as the tendency to respond associatively and nonfoil errors which are assumed to represent only incorrect analogical reasoning (D = foil errors minus nonfoil errors). Children who commit more foil errors than nonfoil errors have been considered to be responding associatively. Children who commit approximately an equal number of foil and nonfoil errors or who commit fewer foil than nonfoil errors are considered to show no excessive reliance on associative responding. Achenbach (1969, 1970a, 1970b, 1971; Kerner & Achenbach, 1971) has labeled the former group either "associative responders" or "high D scorers;" and in the present study, this group is also called "associative responders." Achenbach labeled the latter group either "nonassociative responders" or "low D scorers;" and in the present study, this group is called "relational." This convention was used because the word "relational" seemed more understandable.

Before considering Achenbach's research with the CART, it is noted that the CART is a relatively new and little known instrument. Therefore, a brief discussion of the CART's psychometric properties is presented.

The CART seems to be an adequate psychometric instrument. It was standardized on a large number of subjects (N = 1,085) who were faily heterogeneous in ability and ethnic background; however, the sample was almost totally

composed of white children (Achenbach, 1970b). In addition, this sample was somewhat brighter than average with a mean IQ of about 110. The CART was standardized on groups of children in grades 5 through 8 but seems most appropriate for children in grades 5 and 6. Achenbach has done most of his research with fifth and sixth graders. The relative incidence of associative and relational children in the population of fifth and sixth grade children has not been firmly established, but Achenbach has been able to classify about 70-80 per cent of his subjects as associative or relational responders with roughly 45-50 per cent categorizable as relational and 20-35 per cent categorizable as associative. The number of subjects categorizable has varied depending on cut-off point he has used to eliminate subjects who commit a very large number of errors on both foil and nonfoil items (Achenbach, 1970a, 1970b; Kerner & Achenbach, 1971). A more detailed discussion of his categorization is provided in the Method Section. Finally, the tendency to respond associatively or relationally is relatively stable even after a period of two years (Achenbach, 1971).

Problem Solving

Achenbach (1969, 1970a, 1970b, 1971; Kerner & Achenbach, 1971) has done considerable research on the associative responding style. He has rather consistently found that associative responders obtain significantly lower

scores on group IQ tests, group achievement tests, and school grades than relational responders; however, these differences are usually not of practical significance (i.e., about 5 IQ points and one-half grade level). The differences for the two groups on group tests are not surprising since group ability and achievement tests often contain incorrect alternatives which serve as foils like the CART. On individual IQ tests, he has found no difference between these two response type groups on two of three occasions. He has also found that associative children in contrast to relational children obtain lower teachers' ratings on learning effectiveness and lower scores on individual tests of discrimination and paired associates learning. More significantly, however, he has fairly consistently found that the correlations between ability (IQ and Mental Age) and performance (grades and achievement test scores) are substantially lower for associative than relational subjects even when both groups are matched on group IQ test scores (Achenbach, 1970b). Achenbach (1969) has noted that the low relationship between MA and grades for associative subjects is especially noteworthy when it is considered that responding associatively was likely to have interfered with optimal performance on the group IQ test just as on the CART. Achenbach concluded that the associative child does not generally seem to be using his ability as effectively as his relational peer.

The question of why associative children perform relatively more poorly in school than relational children is rather intriguing; and, as noted above, two general ideas have been offered to provide an explanation.

The first hypothesis is that associative and relational children use different strategies in problem solving and approaching school work. Kerner and Achenbach (1971) administered tasks which seemed capable of differentiating associative (remembering facts and "nonclusterable" objects; divergent sorting of objects) from logical approaches (making inferences from facts, remembering "clusterable" items, and convergent sorting of objects). The results most pertinent to the present discussion were: first, the correlations between the number of clusterable and nonclusterable items remembered per trial were significant for associative children but roughly zero for relational subjects; second, for associative children, the correlations between recall of items and school grades were significant but nonsignificant for relational children; and third, that for relational subjects the correlations between scores on inferential tasks and grades were significant but not for associative subjects. These data suggest that associative and relational subjects may use different strategies in solving problems and approaching school work and that memory processes may be more important in the school work of associative children and inferential processes for the relational child.

In order to look at the performance of associative and relational children on variables related to problem solving, the author turned to a framework for viewing the problem solving process which was presented by Kagan and Kogan (1970). In order to summarize and integrate a large amount of research on individual differences in cognitive processes, Kagan and Kogan presented a five-stage model of problem solving which approximates the chronology of this process. Their framework included the following processes: 1. encoding (attention), 2. memory, 3. hypothesis generation and evaluation, 4. deduction, and 5. public performance. While encoding or attention, memory, and deduction are self-explanatory, the other two functions require further explication. Hypothesis generation and evaluation primarily refer to the subject's relative tendencies to generate a variety of solution hypotheses and evaluate them before responding in contrast to generating only one hypothesis and impulsively acting upon it. With regard to public performance, Kagan and Kogan noted that some type of public performance is necessary to infer and measure cognitive variables. The primary reason they seemed to include public performance in their model and in their discussion was to emphasize the point that in most cases it is unwise to assume that deficiencies in performance indicate deficiencies in cognitive structures. In fairness to Kagan and Kogan (1970), it should be noted that they indicate that

their framework for viewing the problem-solving process does not imply two possible inferences. First, they denied that their choice of functions are the only sources of variation in cognition. They selected the categories mentioned above because these areas have been studied more than other areas. Second, they explicitly deny a linear view of cognition. It is more likely that cognition can best be understood as a chain of processes with feedback loops connecting subsequent with antecedent processes. It should also be noted that, obviously, the phases of problem solving are so intimately related that present technology seems unable to measure the later phases independently of earlier functions. Finally, Kagan and Kogan's framework has not received experimental study.

In order to investigate differences between associative and relational children, the present study included variables related to attention, memory, hypothesis generation and evaluation, and deduction.

Attention. There does not seem to be any research which has studied associative and relational children on aspects of attention. Hence, the author had to look at the ways that attention has been studied to discover aspects of attention which seemed relevant to these two response styles. It was decided to study the two following variables: resistance to distraction and the set to maintain sustained attention. These variables were selected because they

seemed basic to many cognitive activities.

Resistance to distraction has been studied by having the subject perform a task in a situation where task-irrelevant stimuli are introduced by the experimenter (Maccoby, 1967; Santostefano & Paley, 1964). Decrements in performance in the situation with task-irrelevant stimuli in contrast to performance in some control condition have been interpreted as due to distraction. Specifically, task-irrelevant stimuli are assumed to compete with task-relevant stimuli. One method to assess resistance to distraction has been the Stroop Color-Word Test (Stroop, 1935). The Stroop has three parts. First, the subject reads the names of colors, e.g., "red." Second, he names the colors in a series of colored patches to provide an index of speed of naming colors. Finally, the subject names the color of the ink for words which are incongruous with the color of the ink (e.g., the word "blue" is printed in red ink). The first Stroop card is called the Word Card, the second is called the Color Card, and the third is called the Color-Word Card. Jensen and Rohwer (1966) reported that for over 30 years, all investigators have interpreted the consistently poorer performance on the Color-Word Card than on the Color Card or Word Card as due to interference where habits of unequal strength compete and where the stronger habit (reading words) has to be inhibited in favor of the weaker (naming colors). In order to obtain a measure of resistance to

distraction which is independent of speed in naming colors, researchers have used a difference score, i.e., D = time to execute the Color-Word Card minus time to execute the Color Card. Hence, in the present study, it was hypothesized that associative children have a higher difference score than relational children.

The set to maintain sustained attention also seems important for success on many cognitive tasks. Kagan and Kogan (1970) stated that the "motivation to sustain attention on a continuous task is probably one of the most important determinants of quality of performance [p. 1301]." They also ventured the opinion that the maintenance of a set to respond is almost synomymous with sustained attention. Measures of sustained attention differ from measures of distractability in that measures of sustained attention do not specifically contain task-irrelevant stimuli which are included by the experimenter. Instead, it is assumed that sustained attention or task persistence involve the inhibition of response tendencies which compete with the set to continue with the task.

Differences in the set to maintain attention have been studied by assessing reaction time. Zelniker, Jeffrey, Ault, and Parsons (1972) studied scanning strategies and attention with 9 year-olds having either a reflective or impulsive conceptual tempo. They found that reflective and impulsive subjects did not differ in reaction time with

short preparatory intervals, i.e., preparatory intervals which were less than or equal to the mean response latency for impulsive subjects on the Matching Familiar Figures Test. However, in the series with generally longer preparatory intervals (10, 30, and 50 seconds), impulsive children were significantly slower than reflective children; and Zelniker et al. interpreted the difference as due to impulsive children being less able to maintain sustained attention.

Since CART performance has been found to be significantly related to the reflection-impulsivity dimension (Achenbach, 1969), the reaction time procedure mentioned above was used as a measure of sustained attention. Since children become more reflective with age (i.e., they have a longer latency to first response) and since the present study used subjects who were older than those of Zelniker et al., the author selected preparatory intervals which were longer than the mean latency to first response for one sample of fifth graders (Achenbach, 1970a). It was hoped that this approach would be adequate in differentiating the associative and relational children if differences in attention did indeed exist.

Memory. The available data on memory for associative and relational subjects are somewhat equivocal. Associative subjects have been found to do more poorly on discrimination learning tasks and paired-associates tasks (Achen-

bach, 1969, 1970a), but there were no differences between the two groups in memory for facts and for clusterable and nonclusterable items. However, Kerner and Achenbach (1971) noted that these tasks demonstrated ceiling effects.

Since there are data to indicate that visual memory and auditory memory are relatively discrete functions and that the correlations between measures of visual memory and auditory memory may be as low as .17 (McCarthy & Olson, 1964), it seemed important to assess memory across both sensory modalities. In addition, in order to minimize the possibility of ceiling effects which were encountered in the study cited above, the present study used the Digit Span subtest from the Wechsler Intelligence Scale for Children (Wechsler, 1949) and the Revised Visual Retention Test (Benton, 1963). Only children of very superior ability could obtain a perfect score on either test. On the basis of the previous research (Achenbach, 1969, 1970a), it was hypothesized that associative children would obtain lower scores on the two memory tasks than relational children.

Generation and Evaluation of Hypotheses. Most of the research on this phase of problem solving seems to have centered around Kagan's reflection-impulsivity dimension and used the Matching Familiar Figures Test (Kagan & Kogan, 1970). Briefly, in situations involving response uncertainty, the reflective child is slower to respond and makes fewer errors than the impulsive child who is faster and

makes more errors.

The performance of associative and relational children during the phase of generation and evaluation of hypotheses suggests that associative subjects are more impulsive or, at least, are faster in making responses in situations involving uncertainty. Achenbach (1969) found a moderately high correlation between a CART factor score and the reflection-impulsivity dichotomy, but a subsequent analysis of the relationship with less extreme groups of associative and relational subjects was not significant but in the predicted direction, i.e., associative subjects showed a shorter latency to first response and more errors on the Matching Familiar Figures Test. In addition, on a problem solving task, associative subjects were more impulsive, i.e., had a shorter latency to first response, than relational subjects (Achenbach, 1970a).

In order to examine differences between associative and relational children in the hypothesis generation phase of problem solving, several measures were used. The first measure used in the present study was the Matching Familiar Figures Test. Although the standard version of this test is rarely used with children above fourth grade, the adult version (Yando & Kagan, 1968) seemed too difficult. Thus, the standard version was used. It was hypothesized that associative children have a shorter latency to first response and make more errors on the Matching Familiar

Figures Test than relational children.

In addition, two other measures were used to assess the reflection-impulsivity dimension. The latency to first response was recorded for the two measures of deductive reasoning (Problem 31A and 31B) which are included in the Appendix. Both problems seem to fulfill the criteria for situations where the reflection-impulsivity dimension is assumed to operate because both problems appear to involve response uncertainty. The subject is requested to solve a problem, is presented with ten questions he can ask to solve the problem, and is instructed to ask only the questions he thinks he will need to solve the problem. It was hypothesized that associative subjects are more impulsive (i.e., have a shorter latency to first response) than relational subjects on Problems 31A and 31B.

Deduction. There is some research to indicate that associative children perform more poorly than relational children on deductive reasoning tasks. Achenbach (1970a) administered some problem solving tasks which were previously used by Niemark and Lewis (1967). Achenbach found that associative children obtained a significantly lower strategy score than relational children. In addition, Kerner and Achenbach (1971) found that associative children performed significantly more poorly than relational children on tasks requiring them to make inferences from information.

In order to assess differences between associative and relational children, the present study used two of Rimoldi's problems (Rimoldi, Aghi, & Burger, 1968). Rimoldi (Rimoldi, Chlapecka, & Aghi, 1970) developed these problems for two reasons. First, he noted that most previous studies of problem solving were qualitative and impressionistic, e.g., Binet's observations of his daughters, and he wanted to study problem solving in an objective manner. Second, he regarded other research on problem solving as too concerned with the final product (answer) and relatively unconcerned with the actual process of problem solving. Hence, he developed problems which are paradigms of the diagnostic problem solving situation. The subject is confronted with a problem which has a finite number of solutions; and the subject's task is to determine a unique correct solution by gathering information to eliminate incorrect alternative solutions. Specifically, the subject is presented with a problem and questions which can be used to solve the problems. The questions are of two general types (relevant questions and irrelevant questions); however, some relevant questions if asked with other relevant questions become redundant. (A detailed presentation of the scoring system is presented in the Appendix.) The tasks involve presenting subjects with a problem and questions which can be asked to solve the problem. The number, order, and type of questions asked constitute a tactic;

and it is assumed that tactics and thinking processes are closely related.

Several studies have been performed to explore problem solving in children with Rimoldi's Problems. In a study of children between the ages of 7 and 13 years, Rimoldi, Aghi, and Burger (1968) found that with age there is an increase in the excellence of tactics and increased agreement among subjects' tactics. Rimoldi, Chlapecka, and Aghi (1970) performed a longitudinal study of boys who were initially between the ages of 7 and 12 years old. Children between the ages of 7 and 10 years were tested on three occasions at yearly intervals while the 11 and 12 year olds were respectively tested twice and once. Rimoldi et al. also found that there was an increase in the excellence of their subjects' tactics with age. They also found that ability and school grades were significantly related to strategy score.

In order to assess possible differences between associative and relational children in deduction, two of Rimoldi's problems were used. The problems selected were identical in logical structure. Both problems contained two binary units (two major classes each of which had two subclasses). For instance, in Problem 31A, the two major classes were white and black horses each of which was subdivided into farm and race horses. The problems differed in the language in which the problems were presented,

i.e., one was presented in concrete language, the other in abstract language. The Rimoldi problems used differed from those of Niemark and Lewis (1968) in that the former were verbal problems and the latter were visual. It was hypothesized that associative subjects have a lower tactic score on each of the two Rimoldi problems than relational subjects.

Motivation

The second general idea to account for the development of associative responding was derived from research on outer-directedness in retarded individuals. There is considerable research to indicate that failure experiences which occur as a result of using one's ability are an important determinant of outer-directedness in the retarded (Yando & Zigler, 1972). Initially, Achenbach (1969) speculated that experiences of relative failure may also be important in leading the normal child to distrust his own ability to perform and to rely instead on situational cues to solve problems (associative responding). Specifically, Achenbach conjectured that if a child of average ability has siblings who are of superior ability, this child may experience a sense of relative failure much like that of a retarded child surrounded by normal peers.

It was hypothesized that if one's experiences of failure in using one's ability are great enough to lead one to respond associatively in problem situations, then these experiences may be significant enough to affect other adap-

tions. While there is a large number of ways a person may deal with failure, the ones studied, which were derived from social learning theory (Rotter, 1954), were selected because they also have been found to relate to school achievement. Finally, although the names of some of these constructs have cognitive implications (expectancy of success, locus of control, etc.), the researchers who have done the studies which are most pertinent to the present study label them as motivational factors (Battle, 1966; Crandall, Katkovsky, & Crandall, 1965).

Locus of Control, the first variable, is also called internal versus external control of reinforcement. Internal control refers to the perception or belief that the events in one's life (both positive and negative) are the consequence of one's own actions and thereby under personal control. On the other hand, external control refers to the perception or belief that these events are unrelated to one's behavior and therefore beyond personal control, i.e., due to chance, luck, the discretion of powerful others. Internal and external control are viewed as the ends of a continuum with different individuals varying in the degree they construe events as due to internal and external factors. There are data to indicate that one of the factors which leads to the development of an external view of situations is experiences of failure. Epstein and Komorita (1971) and Friend and Neale (1972) conducted

studies of children in grade school where subjects performed a task and were given prearranged failure feedback. Afterwards, the children were asked to indicate the importance of internal factors (ability and effort) versus external factors (task difficulty, luck, the experimenter's approval) in relation to their performance. Both studies indicated that subjects in the failure condition were significantly more external than subjects in the success or no feedback conditions. It seems probable that if a single experimentally induced failure experience can affect a subject's locus of control, a history of failure is likely to have pronounced effects on his views of locus of control.

Since the present study was concerned with school achievement, a locus of control scale which is primarily related to achievement situations was judged to be more appropriate than a scale which assesses locus of control in a variety of situations.

Locus of control for academic situations as measured by the Intellectual Achievement Responsibility Scale (Crandall, Katkowsky, & Crandall, 1965) and the Academic Achievement Accountability Scale (Clifford & Cleary, 1972) have been found to be significantly related to academic achievement with internal subjects obtaining higher scores on various indices of achievement, i.e., grades and scores on achievement tests (Chance, 1965; McGhee & Crandall, 1968; Messer, 1972). In addition, even when ability was

statistically controlled, internal subjects were superior to external subjects although the magnitude of the differences diminished (Clifford & Cleary, 1972; Messer, 1972).

It is likely that children who engage in intellectual achievement behavior in school will engage in this type of behavior outside of school. An internal locus of control has also been found to be related to intellectual achievement behavior outside of school settings. Crandall, Katkovsky, & Preston (1962) studied children who were generally of superior ability while they participated in a day camp. Crandall et al. had observers rate the children during free-play on two variables: first, the amount of time the children spent in intellectual activities as opposed to other activities; and second, the degree of concentration and striving they exhibited in these intellectual activities. Interrater reliabilities ranged from .90 to .98. The findings pertinent to the present discussion were: young boys, but not girls, who took credit for their intellectual performance (internals) spent more time in intellectual free-play activities and showed more concentration and striving in these activities than did boys who assigned responsibility to external factors.

In view of the above findings, it was hypothesized that associative children in the present study are more external than relational children. The locus of control scale used in the present study was the Academic Achieve-

ment Accountability Scale. This scale was selected instead of the Intellectual Achievement Responsibility Scale because it involves substantially less reading than the latter and possesses as adequate internal consistency. Hence, it was hypothesized that associative children are more external (i.e., obtain lower scores on the Academic Achievement Accountability Scale) than relational children.

In order to assess other motivational factors which have also been found to be related to school achievement, three other variables were selected for study, i.e., expectancy of success, minimal goal level, and attainment value for academic performance. These variables were also selected because they seemed to relate to the hypothesis that failure experiences are significant in the development of the style of responding associatively.

Battle (1966) defined expectancy of success for academic performance by taking Rotter's (1954) general definition of expectancy of success and making the definition specific to achievement. Specifically, she defined this variable as "the level of probability held by the individual that a particular reinforcement (in this case, successful academic performance) will occur as a function of a specific behavior on his part (here, effort) in a given situation [p. 636]." As might be expected, expectancy of success for academic performance has been found to be related to successful academic performance. Todd, Terrell,

and Frank (1962), in a study of superior high achieving and low achieving students, found that subjects with a greater expectancy of academic success were more likely to be normal achievers than underachievers. Crandall et al. (1962), cited above, also showed their subjects a series of problems of increasing difficulty and asked them to designate which ones they expected to solve. For boys, expectancy of success was significantly correlated with ratings of intensity of striving in intellectual free-play activities; but these variables were unrelated for girls.

Battle (1966) studied the relationship between a number of motivational variables, one of which was expectancy of success for academic performance, and school grades with a very large (N=500) sample of children in grades seven through nine. Since she found that grades in English and mathematics correlated very highly with the average of grades in all subjects (range of correlations for males and females = .86 to .90), she only studied the relationship between a number of motivational variables for English and mathematics and school grades. The findings pertinent to the present discussion were that expectancy of success in English and mathematics (predicting one's subsequent grades) was substantially related to the grades received. More significantly, however, she found that expectancy of success accounted for more of the variance of school grades than did IQ and that students who were above average in IQ, but

who had low levels of expectancy, performed significantly more poorly than students who had below average ability but who had a high level of expectancy.

In view of the above findings, it was hypothesized that associative children have a lower expectancy of success for academic performance than relational children. Since Battle (1966) found that grades in English and mathematics were very highly related to the average of grades in all subjects, it was decided to only study motivational variables for reading and arithmetic which seem analogous to English and mathematics for slightly older subjects. Hence, it was hypothesized that associative children, in contrast to relational children, have a lower expectancy of success in reading and arithmetic.

The second variable, minimal goal level, refers to the minimum degree of excellence which a child demands of his performance. Crandall et al. (1962) found that for boys minimal goal level was moderately related to intensity of striving in intellectual free-play pursuits, but these variables were unrelated for girls. Battle (1966) also found that minimum goal level accounted for a substantial amount of the variance of grades over and above that which is accounted for by IQ.

Hence, it was hypothesized that associative children have a lower minimal goal level in reading and in arithmetic than relational children.

The third variable, absolute attainment value, refers to the importance a child assigns to competence in academic performance. Crandall et al. (1962) found that for girls attainment value was related to amount of time spent in intellectual free-play and intensity of striving in these activities, but these variables were unrelated for boys. Battle (1966) also found that this variable was modestly associated with grades. Hence, it was hypothesized that associative children rate achievement in reading and in arithmetic as significantly less important for them than relational children.

Battle (1966) found that her measures of expectancy of success, minimal goal level, and attainment value in English and mathematics were all significantly related to one another. In general, measures of the same motivational construct across different school subjects, e.g., attainment value in English and math, correlated more highly together than did motivational constructs within the same school subject. Hence, it was hypothesized that in the present study all of the motivational variables were related to one another.

Since the present study had IQ scores and achievement test scores which were obtained from school records, it was decided to attempt to replicate three findings from previous research. First, since previous research (Achenbach, 1969, 1970b, 1971) has indicated that associative

children obtain lower scores on group IQ tests than relational children, it was hypothesized that the same relationship occurs for the present sample. Second, previous research (Achenbach, 1970a) has also indicated that CART error scores correlated as highly or more highly with school grades and achievement test scores than did Otis IQ scores or Stanford-Binet LM (Short Form) IQ scores. Hence, it was hypothesized that the same relationship occurs in the present sample. Third, one of Achenbach's most consistent findings (1969, 1970a, 1970b, 1971) was that the correlations between ability and achievement measures is lower for associative children than relational children. Hence, it was hypothesized that the same relationship occurs for the present sample.

Lastly, while Achenbach (1969, 1970a) has not found that sex differences affect the relationship between associative responding and performance, in view of the large amount of research on sex differences in intellectual performance (Garai & Scheinfield, 1968), it was decided to determine whether sex differences were important in the present study. In addition, in view of the findings of Crandall et al. (1962) that sex differences affect the relationship between motivational variables and free-play achievement measures, it seemed necessary to assess the role that sex differences may play.

In summary, the following hypotheses were formulated:

1. Associative children are less resistant to distraction than relational children, i.e., the difference score of time to name the colors on the Stroop Color-Word Card (C-W) minus time to name the colors on the Color Card (C) (D = time for C-W minus time for C), is larger for associative children than relational children.
2. Associative children are less able to maintain sustained attention than relational children, i.e., associative children have a longer reaction time after long preparatory intervals than relational children.
3. Associative children have lower scaled scores on WISC Digit Span than relational children.
4. Associative children make fewer correct reproductions on the Revised Visual Retention Test than relational children.
5. Associative children have a shorter latency to first response on the Matching Familiar Figures Test than relational children.
6. Associative children commit more errors on the Matching Familiar Figures Test than relational children.
7. Associative children have a shorter response latency on Problem 31A than relational children.
8. Associative subjects have a shorter response latency on Problem 31B than relational subjects.
9. Associative children have a lower tactic score on Problem 31A than relational children.

10. Associative children have a lower tactic score on Problem 31B than relational children.
11. Associative children are more external in their locus of control, i.e., have lower scores on the Academic Achievement Accountability Scale, than relational children.
12. Associative children have a lower expectancy of success, i.e., expect to receive lower grades in reading and arithmetic, than relational children.
13. Associative children's ratings of the importance of achievement in reading and arithmetic are lower than the ratings made by relational children.
14. The minimal goal levels of associative children for reading and arithmetic are lower than the minimal goal levels of relational children for these subjects.
15. Associative children obtain lower school grades than relational children.
16. Associative children obtain lower scores from the Metropolitan Achievement Test than relational children.
17. The correlations between tasks assumed to measure the same function in relation to problem solving (e.g., memory) are higher than for tasks assumed to measure different functions (e.g., memory and deduction).
18. The motivational measures are all correlated with one another.
19. Associative children obtain lower scores on group IQ

tests than relational children.

20. CART error scores correlate more highly with measures of achievement than with measures of IQ.

21. The correlations between measures of ability and achievement (grades and Metropolitan Achievement Test) are higher for relational than associative children.

CHAPTER II

METHOD

Subjects

A letter was sent to the parents of each of the 170 fifth and sixth grade children in the largely middle class public school where the study was conducted. Approximately 64 per cent (N = 112) of the parents gave permission for their child to be in the study. From this subject pool, 20 children had to be excluded because the school did not have a record of IQ test scores or achievement test scores or because the child had a recorded IQ below 85. The remaining 92 children included 39 boys (14 fifth graders and 25 sixth graders) and 53 girls (20 fifth graders and 33 sixth graders). Their total mean IQ was 109.4 (SD = 10.3) on the Kuhlmann-Anderson which was administered in April of 1970. A further criterion for selecting subjects was their performance on the Children's Associative Responding Test (CART). Of the remaining 92 children, 25 (26%) were categorized as responding associatively on the CART, and 53 (56%) were categorized as responding relationally. From this final subject pool, 40 subjects were randomly selected with the constraints that the final sample include 20

children who solve problems associatively (10 boys and 10 girls) and 20 children (10 boys and 10 girls) who solve problems relationally and that there be an equal number of fifth and sixth graders. For the final sample, the mean Kuhlmann-Anderson IQ for males was 111.4 (SD = 12.2), for females was 108.9 (SD = 8.72), and for the total sample was 110.1 (SD = 10.52). The mean age for the 20 fifth graders was 11.0 years, and the mean age for the 20 sixth graders was 12.0 years.

Measures

The Children's Associative Responding Test (CART), the principal independent measure, is a 68 item, multiple-choice analogies test designed to discriminate between children who solve problems associatively and children who solve problems relationally (See Appendix). The CART possesses good internal consistency for both foil (range of correlations = .83-.90) and nonfoil items (range of correlations = .72-.83) for children in grades 5 through 8. Factor analyses of the CART (Achenbach, 1969; 1970b) have generally produced a unipolar factor with foil items having the highest and nonfoil the lowest factor loadings. In addition, the CART possesses high test-retest reliability over a period of two years, with correlations of .80 for total errors, .75 for foil errors, and .67 for nonfoil errors (Achenbach, 1971).

The CART was scored according to the standard method.

Nonfoil errors were subtracted from the number of foil errors to yield a difference score (D = foil errors minus nonfoil errors). While Achenbach (1970b) has experimented with various cutoff points, he has generally used the cutoff points which were used in the present study because they adequately discriminated between associative and relational children and yet included large percentages of normal school children. Children who obtained a difference score of "4" or more were considered to be responding associatively, and children who obtained a difference score equal to or less than "1" were considered to be responding relationally. Children whose scores did not meet these criteria (i.e., obtained a difference score of "2" or "3"), who committed more than 46 errors (assumed to be performing randomly), or who omitted more than two items were not selected for further study.

The Stroop Color-Word Test was the first measure of attention. The specific Stroop stimuli were taken from the Press Test (Baehr, Corsini, & Renck, 1957), a group version of the Stroop. The matrix of Words, Colors, and Color-Words were taken from a test booklet and affixed to pieces of cardboard. The Stroop was administered as an individual test instead of as a group test because performance on group forms of the Stroop is reported to be highly influenced by clerical speed (Jensen & Rohwer, 1966). The Stroop was administered according to the recommendations

made by Jensen and Rohwer. The task was introduced with instructions which emphasized speed and accuracy. In addition, the examiner followed the subject's progress as the subject performed the three parts of the task and tapped on the table when the subject committed an error. The only score of interest was the difference score based on time to read the Color-Word Card minus the time to read the Color Card. Thus a relatively high score indicated greater distractability. The test-retest reliability over a period of one week has been found to be high: .88 for time to read the Word Card, .79 for the Color Card, and .71 for the Color-Word Card (Jensen, 1965). In addition, a factor analysis of Stroop scores indicated that the difference score of time to execute the Color-Word Card minus time to execute the Color Card had a factor loading of .97 on an "interference factor" (Jensen, 1965).

Reaction Time, the second measure of attention, involved the typical equipment used in experiments of reaction time: Lafayette reaction time equipment and timer. The examiner signalled the beginning of the preparatory interval with the word "Ready," timed the length of the preparatory interval with a stop watch, and initiated the onset of the stimulus. The examiner gazed down during the preparatory intervals to minimize the possibility of providing cues to the subject.

Since this study involved subjects who were older

than those of Zelniker et al. (1972) and who presumably were more reflective, the preparatory intervals used in the present study were: 10, 35, and 50 seconds. Three practice trials, one for each preparatory interval preceded the 15 test trials, 5 for each preparatory interval which were randomly distributed but in the same order for each subject. The score was the mean reaction time per subject for the 35 and 50 second preparatory intervals.

The Digit Span subtest from the Wechsler Intelligence Scale for Children (Wechsler, 1949) was the measure of auditory memory. This task was administered in the standard manner prescribed in the Manual, and age appropriate scaled scores were used.

The Revised Visual Retention Test (Benton, 1963) was used to measure visual memory. Form C of this test was given with Administration A (10 second exposure of each design with immediate reproduction from memory). Administered and scored according to the instructions in the Manual, only the number of correct reproductions was scored. Retest reliability for Administration A has been found to be high, about .85 (Benton, 1963).

The Matching Familiar Figures Test (Kagan, Rosman, Day, Alpert, & Phillips, 1964) is a 12-item, match-to-sample task. It was administered in the standard fashion with two practice items and the standard instructions (See Appendix for full instructions and sample item). The scores used

were latency to first response and number of errors. Kagan and Kogan (1970) presented reliability coefficients of .70 for ten weeks and .62 for one year.

The Rimoldi Problems (Rimoldi et al., 1968) and the two practice items which preceded them are included in the Appendix. Each problem was typed on one 3x5-inch index card and each of the questions for each problem was typed on the face of a separate card with the reverse side containing the question and its answer.

The examiner recorded latency to first response (question selected) after the problem and the questions were read, and the sequence of the questions asked. The sequence of questions used was scored according to Rimoldi's theoretical model of problem solving which distinguished between two tactics in problem solving. The first tactic, from the standpoint of information theory, is considered the ideal one and involves moving from more general questions to more specific ones. The second one involves asking all specific questions (in this case three) to obtain the answer. The sequence of questions is scored to determine the extent to which the subject approximated the ideal tactic. The problems were scored according to the most recent scoring system as reported by Rimoldi et al. (1970) which represents a refinement and redefinition of previous scoring systems. The sequence of questions asked is scored in a manner which places a premium on an ideal tactic (which obtains a

perfect score) and penalizes other tactics and redundant and irrelevant questions. The scoring system involves assigning weights to questions and their order (both positive and negative) and yields a global score, the tactic score. The weights assigned to questions are included in the Appendix. The range of possible scores extends from a high of +1.00 to a low of -1.00.

The Academic Achievement Accountability Questionnaire (Clifford & Cleary, 1972) is a 15-item, locus of control scale. It is presented with the scoring system in the Appendix under the title YOU AND SCHOOL. This scale was introduced with instructions which told the subjects that this measure was not a test, that the experimenter was interested in "how kids your age think about certain things" and that there were no right or wrong answers. The higher the score is the more internal the subject's attitudes. Clifford and Cleary (1972) reported estimated coefficients of internal consistency of .66 and .67 for two samples of fifth and sixth graders.

The measures of Expectancy of Success for reading and for arithmetic (items 1 and 2), Attainment Value for reading and for arithmetic (items 3 and 4), and Minimal Goal Level for reading and for arithmetic (items 5 and 6) were presented together in one questionnaire (see Appendix). Two of the items (3 and 4) were identical to items used by Battle (1966); however, the current use and form of the

present measures differed in four ways from those used by Battle. First, the present subjects were younger than Battle's youngest subjects who were seventh graders, but it was assumed that the measures could be understood by younger subjects if the experimenter provided additional instructions. Second, since the subjects were younger than Battle's, reading was substituted for English on items 1, 3 and 5; and arithmetic was substituted for mathematics on items 2, 4 and 6. Third, the alternatives for items 1, 2, 5, and 6 differed from Battle's measures in that she used a 12-point scale (A, A-, B+,...F); but in the school where the present study was conducted, there was only a 4-point grading scale. Fourth, the items Battle used were embedded among filler items while in the present study the items were presented alone. Data on reliability are lacking.

Each child's scores on IQ tests, with few exceptions the Kuhlmann-Anderson, his scores on the Metropolitan Achievement Test, and his final grades were obtained from the school. The IQ and achievement test scores were the most recent ones available for all of the subjects; however, these tests were administered as long as three years before the study. While more recent data would be desirable, there is data to indicate that measures of ability and school achievement are rather good predictors of performance several years later (Cronbach, 1970).

Eight scores from Metropolitan were used: each

subject's mean stanine score for the seven subtests of the Metropolitan and his stanine score on each of these subtests.

To obtain a numerical score for final school grades, the grades of "Excellent," "Good," "Fair" and "Unsatisfactory" were respectively assigned values of "4," "3," "2," and "1." Only one score was used to indicate school grades which was the average of final grades in eight subject areas. This score was not based on grades in art, music, and physical education.

Procedure

Initially, the experimenter visited the school to enlist the cooperation of the children and to explain the study to them. One week later, the group tests were administered to the subjects in their classroom during school hours. The measures were administered in the following order: the Children's Associative Responding Test, the Academic Achievement Accountability Scale, Expectancy of Success for reading and for arithmetic, Attainment Value for reading and for arithmetic, and Minimum Goal Level for reading and for arithmetic. Code numbers were used in place of names. Each measure was untimed, but all the measures required about an hour to administer.

Two days later, after the CART had been scored, the individual tasks were begun with some of the children. This testing occurred on the stage area of the school audi-

torium and the two small rooms next to the stage which were fairly quiet places. The testing was performed by undergraduate students who were paid by the experimenter and who had been trained to administer the various instruments. The individual tests were administered in two periods, the first about 45 minutes long and the second about one-half hour, in order to minimize fatigue effects. At the first session, the children were administered the following tasks: reaction time, Stroop, WISC Digits, the Revised Visual Retention, and the Matching Familiar Figures Test. These measures were partially counterbalanced except that the same examiner administered Digit Span and the Stroop and Digits always preceded the Stroop to avoid the possibly enduring interference effects. At the second testing, the Rimoldi Problems were given. The testing was done during the last three weeks of school before summer vacation.

Reaction Time was introduced with the following instructions:

> I want to see how fast you can push the button after the red light goes on. As soon as you push the button the light will go off. Sometimes the red light will go on shortly after I say "Ready," and sometimes the light will go on a while after I say "Ready." Remember I want you to push the button as soon as the red light goes on. Let's try some for practice.

For the Rimoldi Problems, the child was introduced to the task by being informed that he was to solve some problems, that he could not solve the problem directly but could figure it out indirectly by using clues and that he

would get the clues by asking certain questions and having these questions answered. The first practice problem was presented followed by the questions the subject could ask to solve the problem which were read to the subject. The child was also informed that he could only ask the questions on the cards, that he could ask any question first, and that he should ask only the questions he needed to solve the problem. He was instructed that when he wanted to ask a question, he should turn the card over to obtain the answer. He was also informed that the examiner also wanted to see how long it took him to solve the problem, but that speed was not important.

The child was helped through the first problem by the examiner's making explicit the implications of the subject's questions. After the problem was solved, the examiner repeated that the subject did not obtain the answer directly, i.e., he did not ask a question and find that the answer to any particular question was the answer to the problem but that he obtained the answer by being led to it by the clues he received from his questions. If the subject failed to comprehend the nature of the task, the examiner solved the problem by using the ideal tactic (see Measures Section) and by verbalizing the implications of the answers he received.

A second practice problem was also given because, for children of this age, several practice problems may be

necessary to have them comprehend the task (Creedon, 1970; Wolf, 1968). After the practice problems were given, the two test items were administered. The examiner first read the problem and then the questions. Problem 31A always preceded 31B. No help was given on the test problems.

CHAPTER III

RESULTS

The data were analyzed with a 2x2 factorial design with the following factors: cognitive style (associative or relational) and sex (male or female). In addition, Pearson product moment correlations were computed. The results are presented in five major sections: (1) descriptive statistics for the sample, (2) preliminary analyses of the data, (3) the results for the variables related to problem solving, (4) the results for the motivational variables, and (5) the correlational analyses.

Descriptive Statistics

The means and standard deviations for males, females, and the total sample are presented in Table 1 for the CART and for the various dependent variables. Sex differences are not discussed here but are discussed later.

For the CART, the present sample generally committed relatively more errors than the fifth and sixth graders in Achenbach's standardization sample (1970b). Achenbach's sample committed about 9.8 foil errors versus 12.35 for the present sample, about 7.2 nonfoil errors versus 9.33 for the present sample, and about 16.5 total errors versus 21.67 for the present sample. The present sample obtained average

Table 1

Descriptive Statistics for Males (N=20), Females (N=20) and Total (N=40) for CART Scores and Dependent Variables

Variables		Males	Females	Total
CART Foil Errors	M	11.85	12.85	12.35
	SD	7.60	7.38	7.41
CART Nonfoil Errors	M	8.75	9.90	9.33
	SD	4.01	4.98	4.50
CART Total Errors	M	20.60	22.75	21.67
	SD	10.83	11.35	11.00
Stroop (seconds)	M	68.15	64.95	66.55
	SD	18.87	20.93	19.74
Reaction Time (seconds)	M	.44	.44	.44
	SD	.16	.12	.14
Digit Span	M	10.50	10.70	10.60
	SD	2.91	2.27	2.58
Visual Retention Test	M	6.60	6.50	6.55
	SD	1.01	1.23	1.13
Matching Familiar Figures Response Latency (seconds)	M	9.22	8.28	8.75
	SD	3.99	4.84	4.40
Matching Familiar Figures Errors	M	8.10	10.60	9.35
	SD	4.27	3.39	4.01
Response Latency-Problem 31A	M	19.80	8.80	14.30
	SD	20.12	5.34	15.56
Response Latency-Problem 31B	M	23.75	13.10	18.42
	SD	25.80	8.77	19.77
Tactic Score-Problem 31A	M	.56	.41	.49
	SD	.29	.39	.35
Tactic Score-Problem 31B	M	.34	.26	.30
	SD	.41	.32	.36
Academic Achievement Accountability	M	13.35	12.15	12.75
	SD	1.79	1.73	1.84
Expectancy of Success-Reading	M	3.55	3.65	3.60
	SD	.69	.49	.59

Table 1 (Contd.)

Descriptive Statistics for Males (N=20), Females (N=20) and Total (N=40) for CART Scores and Dependent Variables

Variables		Males	Females	Total
Expectancy of Success-Arith.	M	3.45	3.40	3.43
	SD	.69	.75	.71
Attainment Value-Reading	M	9.00	8.15	8.58
	SD	1.21	2.11	1.75
Attainment Value-Arith.	M	9.65	9.10	9.38
	SD	.59	2.29	1.67
Minimal Goal Level-Reading	M	2.85	2.75	2.80
	SD	.59	.44	.52
Minimal Goal Level-Arith.	M	2.90	2.65	2.78
	SD	.55	.49	.53
Mean School Grades	M	3.19	3.44	3.31
	SD	.67	.70	.68
Metropolitan Achievement Test Mean Stanine	M	6.87	6.33	6.60
	SD	1.52	1.34	1.44
Metropolitan Achievement Test Word Knowledge	M	6.85	6.20	6.53
	SD	2.03	1.74	1.89
Metropolitan Achievement Test Word Discrimination	M	6.05	6.05	6.05
	SD	2.06	1.70	1.87
Metropolitan Achievement Test Reading	M	6.05	5.70	5.88
	SD	1.76	1.22	1.51
Metropolitan Achievement Test Spelling	M	7.05	6.75	6.90
	SD	1.64	1.33	1.48
Metropolitan Achievement Test Language	M	6.60	6.50	6.55
	SD	1.76	1.61	1.66
Metropolitan Achievement Test Arithmetic Computation	M	8.25	7.10	7.68
	SD	1.55	1.80	1.76
Metropolitan Achievement Test Arith. Problem Solving	M	7.25	5.85	6.55
	SD	1.74	1.93	1.95

scores on Digit Span and on the Revised Visual Retention Test. While the Matching Familiar Figures Test is rarely used with fifth and sixth graders, in comparing the data from the present sample with one sample of fifth graders (Achenbach, 1970a), the present sample responded more quickly on this test, 8.75 seconds for the present sample versus 24.0 for the other sample, and committed fewer errors, 9.35 for the present sample versus about 14.1 for the other sample. These differences might be due to the fact that the present sample was older and may have found the task easier. In comparing the tactic scores for Problems 31A and 31B of the present sample of boys with another sample of boys of comparable age and ability (Rimoldi, et al. 1970), the present sample obtained lower tactic scores. The boys in the present sample obtained mean tactic scores of .56 and .34 on Problems 31A and 31B versus mean tactic scores of .67 and .49 for the other sample on similar problems. No comparable data seem to be available for females. For the Academic Achievement Accountability Scale, the range of possible scores extends from 1 to 15; and the mean score for the standardization sample was about 12.5. The mean score for the total sample was 12.75 which is consistent with the mean of the standardization sample. The following scores were based upon the 4-point grading system used in the school; and hence, the possible range of scores extended from 1 to 4: Expect-

ancy of Success — reading and arithmetic, Minimal Goal Level — reading and arithmetic, and mean school grades. For each of these variables, the subjects obtained scores above the theoretical mean of 2.5. For the two attainment value scores, the range of possible scores extended from a low score of 1 to a high score of 10. The total sample obtained a mean score of 8.58 for reading attainment value and a mean score of 9.38 for arithmetic attainment value; hence, the subjects considered it very important to them to do well in these subjects. Finally, for each of the 7 subtests of the Metropolitan Achievement Test and for the mean stanine score, the subjects obtained scores which were above average.

Preliminary Analyses

IQ. A number of the variables related to problem solving were also likely to be related to IQ, e.g., WISC Digit Span. Therefore, it was important to determine whether the groups differed in IQ. Since the measure of IQ was a group test, the Kuhlmann-Anderson, on the basis of Achenbach's research (1969, 1970a) it was hypothesized (hypothesis 19) that relational children have higher IQ scores than associative children. The means and standard deviations are reported in Table 2, and the results of the ANOVA are reported in Table 3. The main effects of cognitive style and sex and the cognitive style x sex interaction effect were not significant. Hence, the hy-

Table 2

Descriptive Statistics for IQ in relation to Cognitive Style and Sex Groups

Variable		Associative			Relational		
		Males	Females	Total	Males	Females	Total
IQ	M	107.80	107.60	107.70	115.00	110.10	112.55
	SD	13.73	9.99	11.67	9.70	7.56	8.83

Table 3

Analysis of Variance for IQ in relation to Cognitive Style and Sex (N=40)

Source	df	MS	F
Cognitive Style (A)	1	235.38	2.14
Sex (B)	1	65.25	<1.00
A x B	1	55.00	<1.00

pothesis that relational children are brighter than associative children failed to be supported. In considering the standard deviations among the groups, it seems that associative children were more heterogeneous in ability than the relational children.

CART Scores. The means and standard deviations for CART foil errors, nonfoil errors, and total errors are reported in Table 4. Since associative children by definition make more foil errors than nonfoil errors, the large difference between associative and relational children was anticipated. In order to determine whether associative and relational children differed in nonfoil errors and total errors, two 2x2 ANOVAs were computed and the results are contained in Table 5. For nonfoil errors, the main effects and interaction effects were not significant. These results are consistent with Achenbach's findings (1970b) of no difference between associative and relational children in nonfoil errors. For total errors, the main effect of cognitive style was significant beyond the .05 level ($F = 5.48$); but the main effect of sex and the cognitive style x sex interaction were not significant. Associative children committed more errors on the CART than relational children which is also consistent with previous findings (Achenbach, 1970b).

Grades. Since the subjects were selected from five classrooms and their teachers might differ in how they

Table 4

Descriptive Statistics for CART Error Scores in relation to Cognitive Style and Sex

Variables		Groups: Associative			Groups: Relational		
		Males	Females	Total	Males	Females	Total
CART Foil Errors	M	16.40	16.70	16.55	7.30	9.00	8.15
	SD	8.04	7.35	7.50	3.37	5.29	4.40
CART Nonfoil Errors	M	8.70	9.40	9.05	8.80	10.40	9.60
	SD	5.23	4.95	4.97	2.57	5.23	4.10
CART Total Errors	M	25.10	26.10	25.60	16.10	19.40	17.75
	SD	13.10	11.77	12.13	5.57	10.42	8.30

Table 5

Analyses of Variance for CART Nonfoil Errors and Total Errors in relation to Cognitive Style and Sex (N=40)

		Nonfoil Errors		Total Errors	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	3.02	<1.00	616.23	5.48*
Sex (B)	1	13.23	<1.00	46.23	<1.00
A x B	1	2.02	<1.00	13.21	<1.00

*p<.05.

assigned grades, a one way ANOVA was performed. This analysis included all the children who had permission to be in the study, and for whom grades were available. The means, standard deviations, and the number of observations are included in Table 6. The ANOVA was significant beyond the .05 level ($F = 4.84$; $df = 4,91$) which disconfirmed the null hypothesis. Hence, z scores were used in the subsequent analyses.

Problem Solving

Attention. Two hypotheses were made. First, it was hypothesized (hypothesis 1) that associative children are less resistant to distraction than relational children, i.e., the difference score of time to name the colors on the Stroop Color-Word Card minus time to name the colors on the Color Card is larger for associative than relational children. Second, it was hypothesized (hypothesis 2) that associative children are less able to maintain sustained attention than relational children, i.e., associative children have a longer mean reaction time after long preparatory intervals than relational children. The means and standard deviations for the Stroop difference score and Reaction Time are presented in Table 7, and the results of the two ANOVAs are presented in Table 8. For both measures, the main effects of cognitive style and sex and the cognitive style x sex interaction effect failed to be significant. Hence, the hypotheses that associative chil-

Table 6

Descriptive Statistics for Mean Grades for the Two Fifth (5A & B) and Three Sixth Grade Classes (6A, 6B & 6C)

		Classes					
Variable		5A	5B	6A	6B	6C	Total
Grades	M	3.56	2.99	3.71	3.07	3.07	3.28
	SD	.54	.62	.32	.87	.75	.66
	N	18	19	19	22	18	96

Table 7

Descriptive Statistics for the Attentional Measures in relation to Cognitive Style and Sex

Variables		Groups: Associative			Groups: Relational		
		Males	Females	Total	Males	Females	Total
Stroop (seconds)	M	66.50	65.00	65.75	69.80	64.90	67.35
	SD	22.13	24.17	22.57	16.00	18.46	17.00
Reaction Time (seconds)	M	.39	.45	.42	.48	.44	.46
	SD	.14	.12	.13	.18	.12	.15

Table 8

Analyses of Variance for Stroop and Reaction Time in relation to Cognitive Style and Sex (N=40)

		Stroop		Reaction Time	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	25.63	<1.00	.01	<1.00
Sex (B)	1	102.38	<1.00	.00	<1.00
A x B	1	28.88	<1.00	.03	<1.00

dren are more distractible and less able to maintain sustained attention failed to be confirmed.

Memory. Two hypotheses were formulated. First, associative children obtain lower mean scaled scores on Digit Span than relational children (hypothesis 3); and second, associative children obtain a lower mean number of correct reproductions on the Revised Visual Retention Test than relational children (hypothesis 4). The means and standard deviations for these two measures are included in Table 9 and the results of the ANOVAs are contained in Table 10. For both ANOVAs, the main effects and interaction effects were not significant. Hence, the hypotheses that associative children perform more poorly than relational children on memory tasks failed to be confirmed.

Hypothesis Generation and Evaluation. Four hypotheses were made. Associative children have a shorter mean latency to first response on the Matching Familiar Figures Test (hypothesis 5), on Problem 31A (hypothesis 7), and on Problem 31B (hypothesis 8) than relational children. In addition, associative children make a greater mean number of errors on the Matching Familiar Figures Test than relational children (hypothesis 6). The means and standard deviations for these four measures are presented in Table 11; and the results of the ANOVAs are presented in Table 12 (Matching Familiar Figures - latency to first response and errors) and Table 13 (Response latency for

Table 9

Descriptive Statistics for the Memory Measures in relation to Cognitive Style and Sex

Variables		Groups: Associative			Groups: Relational		
		Males	Females	Total	Males	Females	Total
Digit Span	M	10.00	10.80	10.40	11.00	10.60	10.80
	SD	3.13	2.62	2.84	2.75	2.01	2.35
Visual Retention Test	M	6.90	6.50	6.70	6.30	6.50	6.40
	SD	1.20	.85	1.03	.82	1.58	1.23

Table 10

Analyses of Variance for Digit Span and Visual Retention Test in relation to Cognitive Style and Sex (N=40)

		Digit Span		Visual Retention	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	1.60	<1.00	.90	<1.00
Sex (B)	1	.40	<1.00	.10	<1.00
A x B	1	3.60	<1.00	.90	<1.00

Table 11

Descriptive Statistics for the Measures of Hypothesis Generation in relation to Cognitive Style and Sex

Variables		Groups: Associative Males	Associative Females	Associative Total	Relational Males	Relational Females	Relational Total
Matching Familiar Figures Response Latency	M	7.09	7.57	7.33	11.34	8.98	10.16
	SD	2.90	4.20	3.52	3.89	5.54	4.81
Matching Familiar Figures Errors	M	10.30	11.50	10.90	5.90	9.70	7.80
	SD	2.75	3.81	3.29	4.48	2.83	4.14
Response Latency-Problem 31A	M	16.20	9.10	12.65	23.40	8.50	15.95
	SD	19.00	6.76	14.35	21.57	3.78	16.90
Response Latency-Problem 31B	M	18.30	10.80	14.55	29.20	15.40	22.30
	SD	18.05	7.71	14.05	31.84	9.54	23.94

Table 12

Analyses of Variance for Matching Familiar Figures Response Latency and Errors in relation to Cognitive Style and Sex (N=40)

		Response Latency		Errors	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	80.29	4.47*	96.10	7.66**
Sex (B)	1	8.87	<1.00	65.20	4.98*
A x B	1	20.12	1.12	16.90	1.35

*p<.05.

**p<.01.

Table 13

Analyses of Variance for Response Latency on Problem 31A and Problem 31B in relation to Cognitive Style and Sex (N=40)

		Response Latency 31A		Response Latency 31B	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	108.90	<1.00	600.62	1.61
Sex (B)	1	1210.00	5.46*	1134.23	3.05
A x B	1	152.10	<1.00	99.22	<1.00

*p <.05.

problems 31A and 31B). With regard to latency to first response on the Matching Familiar Figures Test, the main effect of cognitive style was significant beyond the .05 level ($F = 4.47$). Associative children had a significantly shorter latency to first response on the Matching Familiar Figures Test. Hence, hypothesis 5 was confirmed. The main effect of sex and the interaction effect for this measure were not significant. With regard to number of errors for the Matching Familiar Figures Test, the main effect of cognitive style was also significant with associative children committing more errors than relational children ($F = 7.66$). Hence, hypothesis 6 was confirmed. In addition, the main effect of sex was also significant ($F = 4.98$) beyond the .05 level. Females committed more errors than males (see Table 1). Lastly the sex x cognitive style interaction effect was not significant. With regard to latency to first response on Problems 31A and 31B, the main effect of cognitive style was not significant for either measure. Hence, the hypotheses that associative children are more impulsive failed to be supported (hypotheses 7 and 8). The main effect of sex was significant beyond the .05 level for Problem 31A ($F = 5.46$) and approached significance for Problem 31B ($F = 3.05$) with females having a shorter latency to first response on both measures (see Table 1). Finally, the cognitive style x sex interaction failed to be significant.

In summary, there was some support for the hypothesis that associative children are more impulsive than relational children. Associative subjects, in contrast to relational subjects, had a shorter latency to first response and committed more errors on the Matching Familiar Figures Test; however, there were no differences between these two response type groups in latency to first response on Problems 31A and 31B. In addition, females were more impulsive than males, i.e., females made more errors on the Matching Familiar Figures Test and had a shorter response latency on Problems 31A and 31B.

Deduction. It was hypothesized that associative children have lower mean tactic scores on Problems 31A and 31B than relational children (hypotheses 9 and 10). The means and standard deviations for these two measures are included in Table 14, and the results of the ANOVAs are reported in Table 15. The main effect of cognitive style was significant for Problem 31A ($F = 4.29$) with associative children obtaining lower strategy scores but not for Problem 31B. Hence, the hypothesis that relational children are superior to associative children in deductive reasoning was supported for Problem 31A and not supported for Problem 31B. Finally, the main effects for sex and the sex x cognitive style interactions for both problems were not significant.

In summary, the hypotheses related to attention and

Table 14

Descriptive Statistics for the Deduction Measures in relation to Cognitive Style and Sex

Variables		Groups: Associative Males	Associative Females	Associative Total	Relational Males	Relational Females	Relational Total
Tactic Score-Problem 31A	M	.45	.31	.38	.67	.52	.60
	SD	.29	.42	.36	.26	.34	.30
Tactic Score-Problem 31B	M	.32	.15	.24	.36	.36	.36
	SD	.32	.32	.32	.50	.29	.39

Table 15

Analyses of Variance for Tactic Scores on Problem 31A and Problem 31B in relation to Cognitive Style and Sex (N=40)

		Tactics on 31A		Tactics on 31B	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	.48	4.29*	.16	1.22
Sex (B)	1	.22	1.96	.08	<1.00
A x B	1	.00	<1.00	.08	<1.00

*p <.05.

memory were not supported; the hypotheses related to generation and evaluation of hypotheses and deduction received mixed support.

Motivation

Locus of Control. It was hypothesized (hypothesis 11) that associative children are more external than relational children, i.e., have lower scores on the Academic Achievement Accountability Scale. The means and standard deviations are found in Table 16, and the results of the ANOVA are found in Table 17. The main effect of cognitive style approached significance ($F = 3.52$) with associative children tending to obtain lower scores. The main effect of sex was significant beyond the .05 level ($F = 5.07$) with females obtaining lower scores than males. Finally the cognitive style x sex interaction effect was not significant.

Expectancy of Success. It was hypothesized that associative children would expect to obtain lower grades in reading and arithmetic than relational children (hypothesis 12). The means and standard deviations for these variables are located in Table 16, and the results of the ANOVAs are located in Table 18. The main effect of cognitive style was highly significant for reading ($F = 13.22$) and was in the predicted direction for arithmetic ($F = 2.38$). Associative children, in contrast to relational children, expected to receive lower grades in reading and tended to

Table 16

Descriptive Statistics for the Motivational Measures in relation to Cognitive Style and Sex

Variables		Groups: Associative Males	Associative Females	Associative Total	Relational Males	Relational Females	Relational Total
Academic Achievement Accountability	M	12.50	12.00	12.25	14.20	12.30	13.25
	SD	1.58	1.25	1.41	1.62	2.16	2.10
Expectancy of Success Reading	M	3.30	3.30	3.30	3.80	4.00	3.90
	SD	.82	.48	.66	.42	.00	.31
Expectancy of Success Arithmetic	M	3.30	3.20	3.25	3.60	3.60	3.60
	SD	.67	.92	.79	.70	.52	.60
Attainment Value Reading	M	8.60	8.30	8.45	9.40	8.00	8.70
	SD	1.43	2.26	1.85	.84	2.05	1.69
Attainment Value Arithmetic	M	9.60	9.10	9.35	9.70	9.10	9.40
	SD	.52	2.18	1.57	.67	2.51	1.82
Minimal Goal Level Reading	M	2.80	2.60	2.70	2.90	2.90	2.90
	SD	.52	2.18	1.57	.67	2.51	1.82
Minimal Goal Level Arithmetic	M	2.80	2.70	2.75	3.00	2.60	2.80
	SD	.63	.48	.55	.47	.52	.52

Table 17

Analysis of Variance for Locus of Control in relation to Cognitive Style and Sex (N=40)

Source	df	MS	F
Cognitive Style (A)	1	10.00	3.52
Sex (B)	1	14.40	5.07*
A x B	1	4.90	1.73

*$p < .05$.

Table 18

Analyses of Variance for Expectancy of Success in Reading and Arithmetic in relation to Cognitive Style and Sex (N=40)

		Reading		Arithmetic	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	3.60	13.22*	1.23	2.38
Sex (B)	1	.10	<1.00	.02	<1.00
A x B	1	.10	<1.00	.02	<1.00

*p <.01.

expect lower grades in arithmetic. Hence, hypothesis 12 received some support.

Attainment Value. It was predicted that associative children, in contrast to relational children, would rate achievement in reading and arithmetic as less important to them (hypothesis 13). The means and standard deviations for these two variables are contained in Table 16, and the results of the ANOVAs are in Table 19. None of the main effects or interaction effects were significant for these two variables. Hence, the hypothesis was not confirmed; and there were no differences between associative and relational children in ratings of the importance to them of academic achievement.

Minimal Goal Level. It was hypothesized that associative children would be satisfied with lower grades in reading and arithmetic than relational children (hypothesis 14). The means and standard deviations for these measures are located in Table 16, and the results of the ANOVAs are found in Table 20. None of the main effects or interaction effects were significant for either variable. Hence, the hypothesis was not confirmed. There were no differences between associative and relational children in regard to the lowest goal they can achieve and still be satisfied.

School Achievement

In view of Achenbach's rather consistent findings

Table 19

Analyses of Variance for Attainment Value in Reading and Arithmetic in relation to Cognitive Style and Sex (N=40)

		Reading		Arithmetic	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	.62	<1.00	.02	<1.00
Sex (B)	1	7.23	2.39	3.02	1.02
A x B	1	3.02	<1.00	.02	<1.00

Table 20

Analyses of Variance for Minimal Goal Level in Reading and Arithmetic in relation to Cognitive Style and Sex (N=40)

		Reading		Arithmetic	
Source	df	MS	F	MS	F
Cognitive Style (A)	1	.40	1.47	.02	<1.00
Sex (B)	1	.10	<1.00	.63	2.23
A x B	1	.10	<1.00	.23	<1.00

that associative children obtain lower grades and lower scores on standardized achievement tests than relational children, it was hypothesized that the same relationship occurs for the present sample (hypotheses 15 and 16). The means and standard deviations for *z* scores of final mean grades, mean stanine score on the Metropolitan Achievement Test, and for the 7 subtests of the Metropolitan are reported in Table 21; and the results of the ANOVAs are presented in Tables 22 (grades) and 23 (mean stanine score and 7 subtests of the Metropolitan). The main effect of cognitive style was significant for Reading ($F = 4.16$) and was in the predicted direction for grades ($F = 3.23$) and the Spelling subtest ($F = 2.22$). Associative children obtained lower Reading scores and tended to obtain lower grades and lower Spelling scores. Hence, of the nine hypotheses, one was confirmed; and two received some support. The main effect of sex was significant beyond the .05 level for the Arithmetic Computation ($F = 4.51$) and Arithmetic Problem Solving subtests ($F = 5.79$) and approached significance for grades ($F = 3.84$). Males obtained higher scores on Arithmetic Computation and Arithmetic Problem Solving, and females tended to obtain higher grades. None of the cognitive style x sex interaction effects were significant.

Correlational Analyses

Problem Solving. It was hypothesized (hypothesis 17)

Table 21

Descriptive Statistics for School Grades and Metropolitan Achievement Test Scores in relation to Cognitive Style and Sex Groups

Variables		Associative			Relational		
		Males	Females	Total	Males	Females	Total
Grades (z scores)	M	-.34	.03	-.26	-.02	.69	.34
	SD	.89	1.04	.96	1.01	.38	.82
Metropolitan Mean Stanine	M	6.61	6.01	6.31	7.13	6.64	6.89
	SD	1.98	1.63	1.80	.90	.96	.94
Metropolitan Word Knowledge	M	6.70	6.10	6.40	7.00	6.30	6.65
	SD	2.54	1.97	2.23	1.49	1.57	1.53
Metropolitan Word Discrimination	M	6.00	5.60	5.80	6.10	6.50	6.30
	SD	2.67	2.07	2.33	1.37	1.18	1.26
Metropolitan Reading	M	5.60	5.20	5.40	6.50	6.20	6.35
	SD	2.17	1.23	1.73	1.18	1.03	1.09
Metropolitan Spelling	M	6.60	6.50	6.55	7.50	7.00	7.25
	SD	1.84	1.43	1.61	1.35	1.25	1.29
Metropolitan Language	M	6.60	6.00	6.30	6.60	7.00	6.80
	SD	2.17	1.89	2.00	1.35	1.15	1.24

Table 21 (Contd.)

Descriptive Statistics for School Grades and Metropolitan Achievement Test Scores in relation to Cognitive Style and Sex Groups

Variables		Associative			Relational		
		Males	Females	Total	Males	Females	Total
Metropolitan Arithmetic Computation	M	8.00	6.90	7.45	8.50	7.30	7.90
	SD	2.00	2.18	2.11	.97	1.42	1.33
Metropolitan Arithmetic Problem Solving	M	6.80	5.50	6.15	7.70	6.20	6.95
	SD	2.10	2.27	2.23	1.25	1.55	1.57

Table 22

Analysis of Variance for School Grades (z scores) in relation to Cognitive Style and Sex (N=40)

Source	df	MS	F
Cognitive Style (A)	1	2.45[a]	3.23
Sex (B)	1	2.91	3.84
A x B	1	.29	<1.00

[a]To make all the z scores positive numbers, the number "2" was added to all the scores.

Table 23

Analysis of Variance for Metropolitan Achievement Test Scores in relation to Cognitive Style and Sex (N=40)

Source	df	Mean Stanine		Word Knowledge		Word Discrimination	
		MS	F	MS	F	MS	F
Cognitive Style (A)	1	3.28	1.58	.63	<1.00	2.50	<1.00
Sex (B)	1	2.97	1.43	4.22	1.13	.00	<1.00
A x B	1	.03	<1.00	.02	<1.00	1.60	<1.00

Table 23 (Contd.)

Analyses of Variance for Metropolitan Achievement Test Scores in relation to Cognitive Style and Sex (N=40)

		Reading		Spelling		Language	
Source	df	MS	F	MS	F	MS	F
Cognitive Style (A)	1	9.02	4.16*	4.90	2.22	2.50	$\lhd$1.00
Sex (B)	1	1.22	$\lhd$1.00	.90	$\lhd$1.00	.10	$\lhd$1.00
A x B	1	1.01	$\lhd$1.00	.40	$\lhd$1.00	2.50	$\lhd$1.00

*$p \lhd .05$.

Table 23 (Contd.)

Analyses of Variance for Metropolitan Achievement Test Scores in relation to Cognitive Style and Sex (N=40)

Source	df	Arithmetic Computation MS	Arithmetic Computation F	Arithmetic Problem Solving MS	Arithmetic Problem Solving F
Cognitive Style (A)	1	2.02	<1.00	6.40	1.89
Sex (B)	1	13.23	4.51*	19.60	5.79*
A x B	1	.02	<1.00	.10	<1.00

*p <.05.

that the measures of attention, memory, generation of hypotheses, and deduction correlate more highly with other measures assumed to tap the same function (e.g., Stroop and Reaction Time) than they correlate with tasks assumed to measure different functions (e.g., Stroop and Digit Span). The matrix of correlations for IQ, the three CART error scores, and the variables related to problem solving for males, females, and the total group are found in Table 24. In view of the very large number of correlations, space dictated that only the .05 level be indicated. Some correlations were significant at even lower probability levels.

For the attentional measures, this hypothesis was not confirmed. The Stroop and Reaction Time were unrelated to one another and were generally unrelated to anything else. The only two exceptions were that for females, the Stroop was inversely related to Tactic Score on 31B and that for males, Reaction Time was inversely related to Tactic Score on Problem 31B. Females showing the most interference on the Stroop did more poorly on Problem 31B than females showing less interference; and males who were less able to maintain sustained attention performed more poorly on Problem 31B than males who were better able to sustain attention. For the memory measures, Digit Span and the number of correct reproductions on the Revised Visual Retention Test were only related for males

Table 24

Correlations between IQ, CART Scores, and Variables related to Problem Solving for Males, Females, and Total

Variables		Variables 1	2	3	4	5	6	7
1. IQ								
2. CART Foil Errors	M	-.64*						
	F	-.29						
	T	-.50**						
3. CART Nonfoil Errors	M	-.61*	.71*					
	F	-.46*	.67*					
	T	-.53**	.69**					
4. CART Total Errors	M	-.68*	.97*	.87*				
	F	-.39	.95*	.88*				
	T	-.55**	.95**	.87**				
5. Reaction Time	M	-.02	.03	.29	.13			
	F	.10	-.08	-.35	-.20			
	T	.02	-.01	-.01	-.01			
6. Stroop	M	-.25	.08	.18	.12	-.17		
	F	-.41	.01	.18	.09	-.07		
	T	-.30	.04	.17	.10	-.13		
7. Digit Span	M	.66*	-.41	-.51*	-.50*	.12	-.38	
	F	.44*	-.21	-.21	-.23	-.02	.13	
	T	.57**	-.34**	-.34**	-.37**	.07	-.15	

Table 24 (Contd.)

Correlations between IQ, CART Scores, and Variables related to Problem Solving for Males, Females, and Total

Variables		Variables 1	2	3	4	5	6	7
8. Visual Retention Test	M	.31	.10	-.13	.02	-.11	-.17	.45*
	F	.53*	-.18	-.33	-.26	.35	-.39	-.06
	T	.40**	-.05	-.25	-.14	.09	-.29	.20
9. Matching Familiar Figures Response Latency	M	-.11	-.40	.00	-.28	.20	.32	-.10
	F	.04	-.25	-.16	-.23	-.28	.11	.07
	T	-.02	-.32**	-.11	-.26	-.03	.21	-.02
10. Matching Familiar Figures Errors	M	-.09	.43*	.12	.34	-.29	.14	-.10
	F	-.39	.26	.29	.29	.13	.18	-.04
	T	-.22	.35**	.23	.33**	-.12	.12	-.06
11. Response Latency Problem 31A	M	-.15	-.20	.06	-.12	.42	-.10	-.22
	F	.32	.04	.03	.04	-.37	-.25	.05
	T	-.02	-.15	.01	-.10	.25	-.07	-.16
12. Response Latency Problem 31B	M	-.07	-.41	-.28	-.39	-.04	-.12	.33
	F	.02	-.38	-.26	-.36	.21	.08	-.14
	T	-.02	-.37**	-.26	-.35**	.00	-.03	.20

Table 24 (Contd.)

Correlations between IQ, CART Scores, and Variables related to Problem Solving for Males, Females, and Total

Variables		Variables 1	2	3	4	5	6	7
13. Tactic Score Problem 31A	M	.55*	-.49*	-.39	-.49*	-.10	-.10	.39
	F	.30	-.32	-.31	-.34	-.17	-.41	.02
	T	.42**	-.39**	-.36**	-.41**	-.13	-.26	.18
14. Tactic Score Problem 31B	M	.15	-.17	-.19	-.19	-.45*	.30	.19
	F	.18	-.28	-.26	-.29	.11	-.44*	-.24
	T	.18	-.22	-.23	-.24	-.25	-.03	.02

Variables		Variables 8	9	10	11	12	13
9. Matching Familiar Figures Response Latency	M	-.41					
	F	.05					
	T	-.13					
10. Matching Familiar Figures Errors	M	.17	-.67*				
	F	-.03	-.48*				
	T	.06	-.56**				
11. Response Latency Problem 31A	M	-.23	.10	-.15			
	F	-.13	.03	-.18			
	T	-.14	.10	-.24			

Table 24 (Contd.)

Correlations between IQ, CART Scores, and Variables related to Problem Solving for Males, Females, and Total

Variables		Variables 8	9	10	11	12	13
12. Response Latency Problem 31B	M	-.28	.24	-.28	.29		
	F	.35	.53*	-.18	-.17		
	T	-.07	.29	-.31	.33*		
13. Tactic Score Problem 31A	M	.20	.00	-.19	-.19	.06	
	F	.22	-.38	-.46*	.17	.37	
	T	.22	.25	-.36**	.01	.18	
14. Tactic Score Problem 31B	M	-.08	.06	.08	-.47*	.18	.42
	F	.19	.31	-.28	-.06	.44*	.75*
	T	.14	.19	-.09	-.30	.24	.57**

*$p < .05$ for a two tailed test with 19 df.

**$p < .05$ " " " " " " 39 df.

(r = .45); and both measures were unrelated to the measures of hypothesis generation and deduction. For the hypothesis generation measures, response latency and number of errors on the Matching Familiar Figures Test were inversely related which is consistent with previous research (Kagan & Kogan, 1970), i.e., the quicker the response the more errors made. Response Latency on Problems 31A and 31B were significantly related for the total sample. However, both of these measures were generally unrelated to response latency and errors on the Matching Familiar Figures Test except that for females, response latency for Problem 31B was significantly related to response latency on the Matching Familiar Figures Test. Finally, the number of errors on the Matching Familiar Figures Test was related to one measure of deduction, Tactic Score on 31A. For the measures of deduction, Tactic Scores on 31A and 31B were more highly related to each other than they were to measures of other functions.

Motivation. Since the motivational measures were all derived from social learning theory, and since Battle (1966) found a number of these variables to be related, it was hypothesized (hypothesis 18) that the motivational variables are all significantly related. The matrix of correlations between IQ, CART errors, and the motivational variables are located in Table 25.

Locus of Control was only related to Expectancy of

Table 25

Correlations of IQ and Two CART Scores with the Motivational Variables for Males, Females, and Total

Variables		IQ	Foil Errors	Nonf. Errors	Variables 1	2	3	4
1. Academic Achievement Accountability	M	.14	-.22	.12				
	F	.15	-.19	-.23				
	T	.18	-.22	-.11				
2. Expectancy of Success-Reading	M	.41	-.26	-.12	.14			
	F	.18	-.64*	-.17	.31			
	T	.32**	-.39**	-.12	.17			
3. Expectancy of Success-Arithmetic	M	.22	-.10	.04	-.09	.45*		
	F	.17	-.40	-.28	.48*	.54*		
	T	.19	-.26	-.15	.20	.48**		
4. Attainment Value Reading	M	.19	-.27	.01	.34	.06	.00	
	F	.11	.12	-.06	.05	.05	.19	
	T	.16	-.04	-.07	.22	.03	.13	
5. Attainment Value Arithmetic	M	.04	.14	.27	-.03	-.15	-.11	.52*
	F	.06	.20	.15	.17	.03	-.12	.74*
	T	.06	.15	.13	.16	-.03	-.09	.69**

Table 25 (Contd.)

Correlations of IQ and Two CART Scores with the Motivational Variables for Males, Females, and Total

Variables		IQ	Foil Errors	Nonf. Errors	Variables 1	2	3	4
6. Minimal Goal Level Reading	M	.33	-.48*	-.64*	.05	.35	-.08	-.30
	F	.34	-.38	-.30	-.09	.30	.18	.04
	T	.34**	-.44**	-.47**	.03	.32**	.03	-.07
7. Minimal Goal Level Arithmetic	M	.28	-.40	-.51*	.04	.15	.40	-.16
	F	.09	-.13	-.30	.25	-.10	.40	.10
	T	.23	-.29	-.41**	.20	.03	.40**	.06

Variables		Variables 5	6
6. Minimal Goal Level Reading	M	-.31	
	F	-.18	
	T	-.15	
7. Minimal Goal Level Arithmetic	M	-.11	.60*
	F	-.25	.54*
	T	-.15	.58**

*$p < .05$ for a two tailed test with 19 df.

**$p < .05$ for a two tailed test with 39 df.

Success in reading for girls. The two measures of Expectancy of Success were significantly related for the total sample (r = .48); but both were generally unrelated to the other variables except that for the total sample, Expectancy of Success in reading was significantly related to Minimal Goal Level in arithmetic. The two measures of Attainment Value were significantly related to one another (r = .69) but were unrelated to the other variables. The measures of Minimal Goal Level were significantly related to one another but were generally unrelated to the other variables. Finally, the correlations between the motivational measures and the CART scores parallel the ANOVAs.

Achievement. On the basis of previous research (Achenbach, 1970b), it was hypothesized (hypothesis 20) that CART foil and nonfoil errors correlate more highly with school achievement than IQ. The correlations of IQ and two types of CART errors are contained in Table 26. The above hypothesis was rather consistently supported for males but received less support for females. For males, of the 18 correlations of CART errors with the achievement measures, 14 of the correlations were somewhat higher than were the correlations between IQ and the achievement test scores; in four of the comparisons, the IQ correlations were somewhat higher. For females, the situation was practically reversed with 11 instances of the correlations between IQ and the achievement indices being higher.

Table 26

Correlations of IQ and Two CART Error Scores with School Grades and Metropolitan Scores for Males (N=20), Females (N=20) and Total (N=40)

		Variables		
Variables		IQ	CART Foil	CART Nonfoil
School Grades (z scores)	M	.62*	-.55*	-.50*
	F	-.02	-.45*	-.06
	T	.32**	-.46**	-.21
Mean Stanine Score	M	.67*	-.78*	-.82*
	F	.46*	-.43*	-.45*
	T	.59**	-.62**	-.63**
Word Knowledge	M	.53*	-.65*	-.70*
	F	.44*	-.25	-.47*
	T	.51**	-.48**	-.58**
Word Discrimination	M	.62*	-.61*	-.78*
	F	.32	-.44*	-.43*
	T	.51**	-.53**	-.58**
Reading	M	.58*	-.72*	-.74*
	F	.37	-.59*	-.45*
	T	.52**	-.66**	-.59**
Spelling	M	.66*	-.68*	-.66*
	F	.45*	-.18	-.21
	T	.59**	-.47**	-.43**
Language	M	.71*	-.61*	-.79*
	F	.51*	-.46*	-.40
	T	.62**	-.54**	-.58**
Arithmetic Computation	M	.27	-.59*	-.50*
	F	.39	-.33	-.27
	T	.34**	-.45**	-.38**
Arithmetic Problem Solving	M	.56*	-.79*	-.71*
	F	.37	-.32	-.34
	T	.47**	-.53**	-.50**

*$p < .05$ for a two tailed test with 19 df.

**$p < .05$ for a two tailed test with 39 df.

Finally, it was hypothesized (hypothesis 21) that the correlations between IQ and the achievement measures are higher for relational subjects than for associative subjects. Table 27 presents the correlations for these variables. The hypothesis was not confirmed for all nine comparisons. The majority of the correlations between IQ and the achievement measures was significant for associative subjects and, in all nine comparisons, were higher than the correlations for relational subjects which were not significant.

Table 27

Correlations between IQ and Achievement Measures for Associative (N=20), Relational (N=20), and Total (N=40)

Variables		Variable IQ
School Grades (z scores)	A	.38
	R	.09
	T	.32**
Metropolitan Achievement Test		
Mean Stanine Score	A	.64*
	R	.42
	T	.59**
Word Knowledge	A	.57*
	R	.36
	T	.51**
Word Discrimination	A	.61*
	R	.23
	T	.51**
Reading	A	.54*
	R	.37
	T	.52**
Spelling	A	.70*
	R	.32
	T	.59**
Language	A	.73*
	R	.35
	T	.62**
Arithmetic Computation	A	.41
	R	.13
	T	.34**
Arithmetic Problem Solving	A	.51*
	R	.31
	T	.47**

*$p < .05$ for a two tailed test with 19 df.

**$p < .05$ " " " " " " 39 df.

CHAPTER IV

DISCUSSION

The discussion of the results is presented in four major sections: (1) variables related to problem solving, (2) motivational variables, (3) achievement, and (4) correlational analyses for dependent measures.

Problem Solving

With regard to the main effect of cognitive style, associative and relational subjects did not differ on the measures of attention, memory, or deductive reasoning for the problem presented in abstract language (Problem 31B). These two response groups also did not differ in latency to first response for the two measures of deduction. However, associative subjects were more impulsive in generating and evaluating solution hypotheses on the Matching Familiar Figures Test than relational subjects. In addition, associative subjects, in contrast to relational subjects, did more poorly on the deductive reasoning problem presented in concrete language (Problem 31A).

If one assumes that the processes of attention, memory, hypothesis generation, and deduction roughly occur in that chronological sequence, then it seems that associative and relational subjects do not necessarily differ

during the first two phases of problem solving. There do not appear to be any previous studies in which possible differences between these two response groups on aspects of attention were explored. The data on memory tasks have been equivocal with some investigators (Achenbach, 1969, 1970a) finding that associative children perform more poorly than relational children and others (Kerner & Achenbach, 1971) finding no differences. Thus, it may be concluded that poorer performance on memory tasks is not an inherent feature of the associative response style. The findings that associative subjects are more impulsive than relational subjects in generating and evaluating solution hypotheses is consistent with previous research (Achenbach, 1969, 1970a). It appears that associative and relational subjects begin at approximately the same point when they attack problems, but when they reach the stage of generating and evaluating solution hypotheses, the two response groups diverge. Associative subjects are more impulsive, and relational subjects are more reflective. Hence, it is not surprising that associative subjects generally do more poorly than relational subjects on deductive and inferential tasks (Achenbach, 1970a, Kerner & Achenbach, 1971). Greater success on these types of tasks generally appear to involve deliberation, and the scoring for these types of tasks places a premium on, from the standpoint of information theory, a "safe"

strategy or tactic. The fact that associative and relational children did not differ on the abstract reasoning problem but did differ on the concrete reasoning problem may be due to the fact that the abstract task was substantially more difficult and hence less discriminating (Rimoldi et al., 1968). In the present study, substantially lower tactic scores were obtained by every subject group for 31B when compared with performance on 31A. The concrete reasoning problem was presented in plain English, the language in which the children were proficient. On the other hand, the abstract problem was presented in an algebraic "language" which the subjects were likely to have found less familiar and more confusing.

In summary, there was some support for the notion that associative and relational subjects approach tasks in different ways. With regard to the main effect of sex, females, in contrast to males, made significantly more errors on the Matching Familiar Figures Test, had a significantly shorter latency to first response on the concrete deductive reasoning problem (31A), and tended to have a shorter response latency for the abstract reasoning problem (31B). The finding for the Matching Familiar Figures Test, is not consistent with previous findings for children of this approximate age (Achenbach, 1970a) or with findings for younger children as reported by Kagan and Kogan (1970). This finding may be due to the fact

that since females mature sooner than males, the female subjects may have been approaching or in pubescence, a time when feelings and impulses are thought to become heightened. Since males generally reach puberty later than females, most of the male subjects were likely to have been prepubertal.

Finally, the sex x cognitive style interaction effect was not significant for any of the variables related to problem solving. Hence, it may be concluded that sex differences did not mediate the relationship between these styles of responding and performance. This finding is consistent with previous research (Achenbach, 1969, 1970a).

Motivation

With regard to cognitive style, associative subjects had a significantly lower expectancy of success in reading and tended to be more external than relational subjects. However, there were no differences between these two response type groups for expectancy of success in arithmetic, for minimum goal level in reading and arithmetic, and for attainment value in reading and in arithmetic. Hence, there was only limited support for the notion that a style of responding associatively may be associated with experiences of failure.

With regard to sex, the only significant difference was that females were more external than males on the locus of control measure. These results are not consistent with

other findings. Clifford and Cleary (1972) also used the Academic Achievement Accountability Scale. In a study of children in grades four through six, they found that females tended to be more internal than males. In addition, in a study of students in grades three through twelve, Crandall et al. (1965) found that from grades three to five females tended to be more internal and from grades six to twelve females were significantly more internal than males. Since the findings of the present study are inconsistent with previous findings, the finding that females are more external than males is regarded with caution and is at present unexplained.

Finally, the sex x cognitive style interaction effects for the motivational variables failed to be significant. Hence, it must be concluded that sex differences do not mediate the relationship between cognitive style and the motivational variables.

Achievement

Regarding the effect of cognitive style on school grades, on mean stanine scores from the Metropolitan Achievement Test, and on the seven subtests of the Metropolitan, the findings indicated that associative subjects, in contrast to relational subjects, obtained significantly lower scores on the Reading subtest and tended to obtain lower grades and lower Spelling scores. Thus, in three of nine comparisons, associative children obtained lower

scores than relational children.

For grades, the present findings were consistent with previous research (Achenbach, 1969, 1970a, 1970b, 1971); but the finding of no difference on the mean score of the Metropolitan was not consistent with this previous research. Two formulations may be offered to explain the divergence. First, the present investigator had access to less recent data (achievement test scores which were three years old) than that used in previous research. Second, the previous research was based on mean percentile scores while the present study used mean stanine scores. Stanine scores have a much smaller range than percentiles; and, hence, stanines offer less possibility for fine discriminations.

In view of these limitations, the findings for the Reading and the Spelling subtests are best considered tentative. Associative children obtained lower stanine scores on Reading and tended to obtain lower stanine scores on Spelling. Since the previous research, cited above, has not reported separate analyses for subtests of achievement tests, the findings for Reading and Spelling are not paralleled by other studies. One hypothesis may be offered to account for these differences. Since reading and spelling skills are basic to success in many school subjects, associative children may generally perform more poorly in school than relational children because associative chil-

dren lag behind in these basic skills. Nevertheless, it is open to question why an associative style should be associated with relative lags in reading and spelling and not with lags in word discrimination and language which also seem to be basic skills.

It was also hypothesized that the correlations of Children's Associative Responding Test (CART) error scores with grades and Metropolitan Achievement Test scores are higher than the correlations of IQ with grades and these achievement test scores. For males, of the 18 correlations of CART error scores with the achievement measures, 14 of the correlations were somewhat higher than were the correlations between IQ and the achievement tests; in four of the comparisons, the IQ correlations were somewhat higher. For females, the situation was practically reversed with 11 instances of the correlations between IQ and the achievement indices being greater. Thus, it appears that for males CART scores may possibly predict achievement better than IQ while the reverse is true for females. These findings for females are consistent with previous research. Kagan (1966) noted that, in general, IQ is a better predictor of achievement for girls than for boys. In considering the correlations of CART foil and nonfoil error scores with grades and the achievement test scores in relation to the correlations of IQ with these same variables, the magnitude of the correlations of the CART with the other two varia-

bles is striking in view of the fact that the Kuhlmann-Anderson and the Metropolitan were given at the same time while the CART was administered three years later. These findings are also consistent with the findings of Achenbach (1971) who found similar relationships for a period of two years.

Finally, the majority of correlations between IQ and the indices of achievement was significant for associative subjects and generally higher than the correlations for relational subjects which were generally insignificant. These findings were contradictory to the hypotheses as well as to the consistent findings of previous research (Achenbach 1969, 1970a, 1970b, 1971). The reason for these anomalous findings is not obvious and warrants further research. Indeed, the findings that the correlations between ability indices and achievement measures were higher for associative subjects than for relational subjects seem to strike at the foundations of the construct of associative responding. The main justification for this construct is the data that the correlations between ability and achievement are lower for associative than for relational subjects. One consideration is offered to account for these anomalous findings in the present study. Associative subjects were more heterogeneous on both the measures of ability and all the indices of achievement than the relational subjects, i.e., the standard deviations were somewhat larger for the

associative subjects than for the relational subjects. Hence, the findings may be due to a statistical artifact arising from the more limited distribution for relational subjects and the consequent limitation on the magnitude of the correlations.

Finally, males obtained higher scores on the Arithmetic Computation and Arithmetic Problem Solving subtests and females obtained higher school grades. These findings are consistent with the findings of other investigators as reported by Garai and Scheinfield (1968). Males generally perform better than females on arithmetic tasks, and females generally obtain higher grades.

Correlations for Dependent Variables

Problem Solving. It was hypothesized that measures assumed to assess the same function in relation to problem solving correlate more highly than measures assumed to tap different variables. This hypothesis was supported for the measures of memory, generation and evaluation of hypotheses, and deduction. However, the measures of memory were more highly related to IQ than they were to each other. This finding was not entirely unexpected in view of the fact that some measures of visual and auditory memory have been found to be unrelated (McCarthy & Olson, 1964). In addition, the hypothesis was not supported for the attentional measures (Stroop and Reaction Time). Hence, it would appear that the Stroop and Reaction Time measure unrelated

aspects of attention. In general, the correlations between the Stroop and the other measures were in the expected direction more often than the correlations for Reaction Time. Since high scores on both attentional measures indicate poorer performance, one would expect that both attentional measures would be inversely related to IQ, Digit Span, Visual Retention scores, and both tactic scores and that both attentional measures would be positively related to CART and Matching Familiar Figures error scores. In general, these relationships occurred more often for the Stroop than Reaction Time. Finally, except for the memory measures and tactic score on the concrete problem, the other measures were not significantly related to IQ.

Motivation. Locus of control (Academic Achievement Accountability) was generally unrelated to the other motivational measures except that it was significantly related to expectancy of success in arithmetic for females. While locus of control and the constructs of expectancy of success, attainment value, and minimum goal level were derived from social learning theory, there seems to be only one study which presented correlations between locus of control and expectancy of success. Clifford and Cleary (1972) also used the Academic Achievement Accountability Scale but used a different measure of expectancy of success. Their measure of expectancy of success (i.e., level score) consisted of presenting the subject with a series of school

achievement tasks at five levels of difficulty and instructing him to find and do the most difficult level on which he thought he could do well. They found no significant relationship between locus of control and their expectancy measure which is consistent with the findings for males and for the total sample on the expectancy of success measures. Hence, the findings for females require subsequent validation.

The measures of expectancy of success, attainment value, and minimal goal level in reading were significantly related to their respective measures in arithmetic. Subjects who expected to do well in reading also expected to do well in arithmetic. Subjects who felt it was important for them to do well in reading also felt it was important for them to do well in arithmetic. Finally, subjects who had higher minimal goals in reading had higher minimal goals in arithmetic. In comparing the correlations for these motivational variables with those of Battle (1966), the findings for variables across subject matter (e.g., the correlation of expectancy of success in reading with expectancy for arithmetic) parallel Battle's results. She found correlations of .51 between expectancy of success in English and mathematics versus .48 for the present sample for reading and arithmetic, of .62 for minimal goals versus .58 for the present sample, and .47 for attainment value versus .69 for the present sample.

Battle's findings for the motivational measures within subject matter differ from those of the present study. Battle found that expectancy of success in mathematics correlated .65 and .41 with minimum goals and attainment value respectively. The present study found correlations of -.09 and .40 for these variables. Battle also found that expectancy of success in English correlated .73 and .45 with minimum goals and attainment value in English versus .03 and .22 for the present sample for reading. The differences in the correlations for Battle's study and the present study may be due to the fact that the present sample was substantially smaller than Battle's or, even more probably, may be due to differences in the measures which are discussed in the Method Section.

Finally, the motivational variables tended to relate more highly with CART error scores than to IQ. This finding may be due to the fact that the CART and the motivational measures were administered at the same time or may suggest that motivational factors may be related to a style of responding associatively.

In making an overview of the findings of the present study, the data indicated that the associative responding style was more highly related to problem-solving factors than to motivational factors. In other words, the current results gave greater support to the cognitively focused theory regarding the determinants of associative responding

than to the motivational notion. Hence, it appears that remedial efforts might more profitably be oriented toward modifying the associative child's problem-solving style or making related curriculum adjustments than engaging him in counseling or psychotherapy to alter motivational status. Since associative responding has been consistently found to be related to the impulsive end of the reflection-impulsivity dimension, experimentation with remediation procedures might start with procedures designed to modify an impulsive conceptual tempo. Kagan and Kogan (1970) reviewed the literature on the modification of impulsive responding and suggested that this research has followed two basic trends. The first line of research has assumed that the impulsive child commits more errors because he responds too quickly. Hence, this line of research has attempted to increase the response latency of impulsive subjects. A variety of procedures has been used to accomplish this goal including training the child to delay responding and the modeling of a reflective approach by teachers and by older children. While this line of research has been successful in increasing the subject's response latency, it has not been successful in decreasing the number of errors that the child makes. Although this line of research has not been successful in increasing the impulsive child's accuracy, the use of these types of methods might be more successful with the associative responding style. In addition,

the idea of assigning students with teachers who have a similar or different style is intuitively appealing and warrants further study. The second research direction which seems to consist of only one study has focused on accuracy and disregarded speed. This research has found that training which emphasizes accuracy decreases errors and increases response latency. While the results of one study must be considered suggestive, one would wonder whether this procedure might be beneficial in modifying an associative response style.

Before modification efforts are instituted, a number of basic questions require answers. First, what are the assets of an associative style? There is evidence that risk-taking which seems related to an associative style is also associated with creativity (Kogan & Wallach, 1964). While Kerner and Achenbach (1971) found no differences between associative and relational subjects on one measure of creativity (divergent sorting of objects), these results can hardly be regarded as definitive. Subsequent research might further explore the relationship of associative responding with creativity and other assets. Second, what variables moderate the associative responding style? In view of the present findings, sex may not be a significant moderating variable, but IQ may be a significant one. The associative subjects in the present sample were more heterogeneous in ability than the relational subjects. Hence,

one would wonder whether IQ may be a significant moderating variable. Other potential moderating variables would include test anxiety and defensiveness. Kogan (1971) presented data to suggest that these variables may be important mediators of risk-taking. Third, is associative responding best considered as a univariate trait or is it possible to discriminate levels or variations of this trait. The present research and all previous research has considered the child who obtains a difference score (D = foil errors minus nonfoil errors) of 4 to be roughly equivalent to a child who obtains a difference score of 40. Is this assumption tenable? Fourth, what is the relationship of associative responding to other cognitive styles? Future research may further explore the relationship of associative responding to an impulsive cognitive tempo, risk-taking, field dependence and other variables.

Further research might also explore other aspects of problem solving and motivation. With regard to problem solving, investigators might explore possible differences in scanning strategy, concept formation, and other cognitive variables with associative and relational children. With regard to motivation, subsequent research might explore other variables related to failure such as self concept and self esteem, might manipulate motivational variables with different types of instructions, or might induce experimental failure experiences to assess potential

differences between associative and relational children.

SUMMARY

Previous research has consistently indicated that the correlations between ability measures and achievement measures are substantially lower for children who solve problems associatively than for children who use a relational approach. Hence, associative children do not appear to be using their ability as effectively as relational children. Two ideas have been offered to account for the determinants of associative responding. The first suggests that associative children have a strategy style of problem solving and of approaching tasks which is not adaptive to school. The second suggests that failure experiences may be important in the development of a style of responding associatively.

The present study was designed to explore both hypotheses. To explore the first, the subjects were administered measures assumed to assess performance at four stages in the problem solving process (i.e., attention, memory, generation and evaluation of solution hypotheses, and deduction). To explore the second hypothesis, the subjects were also given measures assumed to relate to failure experiences (i.e., locus of control; expectancy of success, attainment value, and minimal goal level in reading and in arithmetic. In order to assess possible dif-

ferences between associative and relational children and possible sex differences, a 2x2 (associative vs. relational x sex) factorial design was used.

The findings were: (a) associative and relational children did not differ on measures of attention, memory, and abstract deductive reasoning; (b) associative children were more impulsive in generating and evaluating solution hypotheses and performed more poorly on concrete deductive reasoning problems than relational children; (c) females were more impulsive than males; (d) associative subjects obtained lower achievement scores in reading and tended to obtain lower grades and lower achievement scores in spelling than relational children; (e) no differences were observed on other achievement measures; (f) associative subjects had a lower expectancy of success in reading and tended to be more external than relational subjects; (g) females were more external than males; (h) measures of memory, generation of hypotheses, and deduction correlated more highly with other measures of the same function than they did with measures of other functions; (i) the attentional measures were unrelated; (j) the measures of expectancy of success, attainment value, and minimal goal level in reading and in arithmetic correlated better across school subjects than within school subjects; (k) contrary to expectations, the correlations between ability and achievement measures were higher for associative than for

relational subjects. Further research was suggested.

REFERENCES

Achenbach, T. Cue learning, associative responding, and school performance in children. Developmental Psychology, 1969, 1, 717-725.

Achenbach, T. The Children's Associative Responding Test: a possible alternative to group IQ tests. Journal of Educational Psychology, 1970, 61, 340-348. (a)

Achenbach, T. Standardization of a research instrument for identifying associative responding in children. Developmental Psychology, 1970, 2, 283-291. (b)

Achenbach, T. The Children's Associative Responding Test: a two year follow-up. Developmental Psychology, 1971, 5, 477-483.

Achenbach, T., & Zigler, E. Cue-learning and problem-learning strategies in normal and retarded children. Child Development, 1968, 39, 827-848.

Baehr, M., Corsini, R., & Renck, R. The Press Test. Chicago: The Education-Industry Service, 1957.

Battle, E. Motivational determinants of academic competence. Journal of Personality and Social Psychology, 1966, 4, 634-642.

Benton, A. The Revised Visual Retention Test. (3rd ed.) New York: Psychological Corp., 1963.

Clifford, M., & Cleary, T. The relationship between children's academic performance and achievement accountability. Child Development, 1972, 43, 647-655.

Crandall, V., Katkovsky, W., & Crandall, V. Children's beliefs in their own control of reinforcements in intellectual academic achievement situations. Child Development, 1965, 36, 91-109.

Crandall, V., Katkovsky, W., & Preston, A. Motivational and ability determinants of children's intellectual achievement behaviors. Child Development, 1962, 33, 643-661.

Crandall, V., & McGhee, P. Expectancy of reinforcement and academic competence. Journal of Personality, 1968, 36, 635-648.

Creedon, H. Cognitive processes in emotionally disturbed boys: a comparison of problem solving processes used by matched groups of disturbed and nondisturbed boys. Unpublished doctoral dissertation, Loyola University of Chicago, 1970.

Cronbach, L. Essentials of psychological testing. (3rd ed.) New York: Harper & Row, 1970.

Epstein, R., & Komorita, S. Self-esteem, success-failure, and locus of control in Negro children. Developmental Psychology, 1971, 4, 2-8.

Friend, R., & Neale, J. Children's perceptions of success and failure. Developmental Psychology, 1972, 7, 124-128.

Garai, J., & Scheinfield, A. Sex differences in mental and behavioral traits. Genetic Psychology Monographs, 1968, 77, 169-299.

Gardner, R. Cognitive styles in categorizing behavior. Journal of Personality, 1953, 22, 214-233.

Gardner, R., Holzman, P., Klein, G., Linton, H., & Spence, D. Cognitive control: a study of individual consistencies in cognitive behavior. Psychological Issues, 1960, 2, No. 4 (Monograph 8).

Jensen, A. Scoring the Stroop Test. Acta Psychologica, 1965, 24, 612-621.

Jensen, A., & Rohwer, W. The Stroop Color-Word Test: a review. Acta Psychologica, 1966, 25, 36-93.

Kagan, J. Reflection-impulsivity and reading ability in primary grade children. Child Development, 1965, 36, 609-628.

Kagan, J. Reflection-impulsivity: the generality and dynamics of conceptual tempo. Journal of Abnormal Psychology, 1966, 71, 17-24.

Kagan, J., & Kogan, N. Individual variation in cognitive processes. In P. Mussen (Ed.) Carmichael's manual of child psychology. New York: John Wiley, 1970, p. 1273-1365.

Kagan, J., Rosman, B., Day, P., Alpert, J., & Phillips, W. Information processing in the child: significance of analytic and reflective attitudes. Psychological Monographs, 1964, 78 (1, Whole No. 578).

Kerner, M., & Achenbach, T. The Children's Associative Responding Test: its relation to individual tests of recall, comprehension, and concept formation. Psychological Reports, 1971, 29, 119-125.

Kogan, N. Educational implications of cognitive styles. In G. Lesser (Ed.) Psychology and educational practice. Glenview, Ill: Scott, Foresman, 1971, p. 242-92.

Kogan, N., & Wallach, M. Risk-taking: a study in cognition and personality. New York: Holt, Rinehart, & Winston, 1964.

Maccoby, E. Selective auditory attention in children. In L. Lipsitt and C. Spiker (Eds.) Advances in child development and behavior. Vol. 3. New York: Academic Press, 1967, p. 99-124.

McCarthy, J., & Olson, J. Validity studies on the Illinois Test of Psycholinguistic Ability. Department of Exceptional Education, University of Wisconsin, Milwaukee, 1964.

McGhee, P., & Crandall, V. Beliefs in internal-external control of reinforcements and academic performance. Child Development, 1968, 39, 91-102.

Messer, S. The relation of internal-external control to academic performance. Child Development, 1972, 43, 1456-1462.

Niemark, E., & Lewis, N. The effect of incentives upon information-gathering in diagnostic problem-solving. Journal of Genetic Psychology, 1967, 111, 195-202.

Rimoldi, H., Aghi, M., & Burgher, G. Some effects of logical structure, language and age in problem solving in children. Journal of Genetic Psychology, 1968, 73, 368-375.

Rimoldi, H., Chlapecka, T., & Aghi, M. Problem solving processes used by elementary school boys. Loyola Psychometric Laboratory, Loyola University, Chicago, Ill., 1970.

Rotter, J. Social learning and clinical psychology. Englewood Cliffs, N. J.: Prentice-Hall, 1954.

Saunders, B., Zigler, E., & Butterfield, E. Outer-directedness in the discrimination learning of normal and mentally retarded children. Journal of Abnormal Psychology, 1968, 73, 368-375.

Santostefano, A., & Paley, E. Development of cognitive controls in children. Child Development, 1964, 35, 939-949.

Stroop, J. Studies in interference in serial learning. Journal of Experimental Psychology, 1935, 18, 643-662.

Todd, F., Terrell, G., & Frank, C. Differences between normal and underachievers of superior ability. Journal of Applied Psychology, 1962, 46, 183-190.

Turnure, J., & Zigler, E. Outer-directedness in the problem-solving of normal and retarded children. Journal of Abnormal and Social Psychology, 1964, 69, 427-436.

Wechsler, D. The Wechsler Intelligence Scale for Children. New York: Psychological Corp., 1949.

Witkin, H., Lewis, H., Hertzman, M., Machover, K., Meissner, P., & Wapner, S. Personality through perception New York: Hayser, 1954.

Wolf, P. Field independent girls and their ability to solve problems while distracted. Unpublished doctoral dissertation, Loyola University of Chicago, 1969.

Yando, R., & Kagan J. The effect of teacher tempo on the child. Child Development, 1968, 39, 27-34.

Yando, R., & Zigler, E. Outer-directedness and imitative behavior of institutionalized and non-institutionalized younger and older children. Child Development, 1972, 43, 315-327.

Zelnicker, T., Jeffrey, M., Ault, R., & Parsons, R. Analysis and modification of search strategies of impulsive and reflective children on the Matching Familiar Figures Test. Child Development, 1972, 43, 321-335.

APPENDIX

Children's Associative Responding Test

CODE NUMBER_____

INSTRUCTIONS

Please read the following example:

Example a.

Sweet is to sugar as sour is to: candy, peach, lemon, bread, knife

The correct answer is, of course, "lemon." "Sweet" describes the taste of "sugar" just as "sour" describes the taste of "lemon," so "lemon" is circled.

Now circle the correct answer in the next example:

Example b.

Big is to little as wide is to: black, round, narrow, down, tall

You should have circled "narrow" because "narrow" relates to "wide" in the same way that "little" relates to "big."

Be careful on the next example:

Example c.

Horse is to colt as cow is to: field, milk, kitten, people, calf

"Calf" is the correct answer because a "calf" is a young "cow" just as a "colt" is a young "horse."

Here is one more example:

Example d.

Father is to mother as uncle is to: cousin, brother, sister, aunt, man

"Aunt" is the correct answer because it is related to "uncle" in the same way that "mother" is related to "father."

This test contains 68 items like Examples a, b, c, and d. For each item, circle the one answer that you think is best. Do not circle more than one answer for any item. If you make a mistake, cross it out. Do not skip any items, but do not spend too much time on any one item. Guess if you are not sure of the correct answer.

Remember--do not skip any items

1. Pig is to boar as dog is to: 1.cat 2.smoke 3.ant 4.turtle 5.wolf
2. Sun is to solar as moon is to: 1.lunar 2.radar 3.sonar 4.diameter 5.motor
3. House is to build as carpet is to: 1.rug 2.melt 3.weave 4.grand 5.coat
4. Keep is to retain as have is to: 1.pain 2.lot 3.power 4.recess 5.possess
5. Birds is to peck as kittens is to: 1.punch 2.cat 3.box 4.scratch 5.ram
6. Affection is to friend as anger is to: 1.mad 2.enemy 3.spoon 4.cart 5.tray
7. Animal is to zoo as blossom is to: 1.sidewalk 2.picture 3.paper 4.flower 5.garden
8. Taller is to height as broader is to: 1.stiff 2.overcome 3.amount 4.long 5.width
9. Slowly is to walk as quietly is to: 1.rang 2.speak 3.want 4.open 5.fall
10. Clear is to glass as hard is to: 1.steel 2.left 3.sweet 4.out 5.soft
11. Defend is to attack as for is to: 1.great 2.yet 3.laugh 4.pray 5.against
12. Teach is to teacher as sell is to: 1.shade 2.pole 3.merchant 4.buy 5.mailman
13. Food is to starved as sleep is to: 1.exhausted 2.create 3.switch 4.needed 5.feared
14. Bear is to cave as boy is to: 1.top 2.letter 3.girl 4.shell 5.house
15. Wish is to future as memory is to: 1.think 2.mind 3.head 4.past 5.hunter
16. Hungry is to fed as afraid is to: 1.shoes 2.wrote 3.scared 4.protected 5.told
17. And is to both as or is to: 1.way 2.either 3.tell 4.only 5.nugget
18. Bigger is to enlarge as clearer is to: 1.camera 2.explain 3.easy 4.word 5.photo
19. Beggar is to rags as king is to: 1.queen 2.high 3.robes 4.far 5.page
20. When is to time as how is to: 1.brush 2.turn 3.method 4.if 5.yes
21. Furnace is to cold as lamp is to: 1.strange 2.colored 3.paw 4.dark 5.light
22. Prize is to awarded as wish is to: 1.avoided 2.sent 3.liked 4.counted 5.granted
23. Bee is to hive as man is to: 1.pepper 2.tree 3.woman 4.nest 5.city
24. Island is to oasis as ocean is to: 1.water 2.second 3.start 4.desert 5.distant
25. Hedge is to trim as bed is to: 1.crate 2.root 3.sleep 4.make 5.saw
26. There is to where as because is to: 1.are 2.no 3.why 4.time 5.need
27. Speedy is to rabbit as slow is to: 1.snail 2.garage 3.fit 4.lunch 5.fast
28. Truck is to crane as carry is to: 1.heavy 2.lift 3.heap 4.strong 5.weight

29. Begin is to start as happen is to: 1.occur 2.depart 3.watch 4.send 5.go

30. Under is to below as on is to: 1.sport 2.above 3.pencil 4.off 5.ran

31. Your is to yours as my is to: 1.his 2.our 3.you 4.hers 5.mine

32. Sorrow is to happiness as trouble is to: 1.rest 2.success 3.give 4.seek 5.axe

33. Mouse is to trap as bug is to: 1.let 2.insect 3.ocean 4.toss 5.spray

34. Pleasant is to unpleasant as music is to: 1.noise 2.pottery 3.pretty 4.nice 5.play

35. Five is to number as black is to: 1.white 2.grow 3.color 4.plant 5.hardware

36. Banana is to apple as long is to: 1.salad 2.short 3.cape 4.round 5.sour

37. Wing is to fin as eagle is to: 1.able 2.bird 3. show 4.fish 5.hint

38. One is to many as that is to: 1.it 2.of 3.sold 4.those 5.owner

39. Court is to tennis as table is to: 1.ping-pong 2.spread 3.skate 4.chair 5.football

40. Bright is to sunny as dark is to: 1.wax 2.fur 3.light 4.cloudy 5.thin

41. Replace is to another as restore is to: 1.cost 2.lean 3.original 4.took 5.tack

42. Tiny is to baby as tall is to: 1.short 2.reach 3.spark 4.giant 5.rear

43. Deep is to dive as high is to: 1.climb 2.wash 3.seem 4.sure 5.low

44. Hand is to throw as foot is to: 1.trip 2.ground 3.kick 4.ache 5.crawl

45. Buy is to buyer as take is to: 1.price 2.store 3.hold 4.sale 5.thief

46. Sorrow is to cry as joy is to: 1.happy 2.live 3.red 4.walk 5.sing

47. Eye is to needle as head is to: 1.nail 2.sun 3.pen 4.tractor 5.blade

48. Saw is to wood as scissors is to: 1.sit 2.string 3.cut 4.front 5.mouse

49. For is to reader as by is to: 1.robbed 2.plain 3.master 4.author 5.donate

50. Graceful is to dancer as swift is to: 1.corn 2.runner 3.pit 4.table 5.fast

51. Investigate is to detective as examine is to: 1.pilot 2.hear 3.see 4.doctor 5.ill

52. Cold is to ice as salty is to: 1.party 2.plate 3.nuts 4.glass 5.napkin

53. Across is to floor as up is to: 1.farm 2.down 3.smile 4.ugly 5.stairs

54. Those is to several as the is to: 1.near 2.time 3.under 4.message 5.one

55. Piano is to fingers as whistle is to: 1.lips 2.throat 3.loud 4.face 5.song

56. Castle is to king as cottage is to: 1.track 2.house 3.peasant 4.march 5. juice

57. Girl is to doll as woman is to: 1.baby 2.shovel 3.brick 4.man 5.truck

58. Is is to now as was is to: 1.along 2.today 3.then 4.nor 5.tomorrow

59. Why is to reason as who is to: 1.thing 2.what 3.mystery 4.learn 5.person

60. Red is to crayon as white is to: 1.shake 2.mud 3.yard 4.chalk 5.black

61. Multiply is to product as add is to: 1.brown 2.subtract 3.field 4.eye 5.sum

62. Yes is to no as allow is to: 1.refuse 2.answer 3.punish 4.help 5.aid

63. Car is to gas as you is to: 1.me 2.over 3.bin 4.food 5.oh

64. Blue is to color as sad is to: 1.most 2.mood 3.get 4.happy 5.ton

65. Always is to never as usually is to: 1.returned 2.all 3.seldom 4.however 5.since

66. Like is to love as comfort is to: 1.glad 2.coat 3.luxury 4.cold 5.help

67. Build is to destroy as maintain is to: 1.never 2.quite 3.when 4.combine 5.neglect

68. Lose is to loss as get is to: 1.fail 2.gain 3.gone 4.give 5.rent

Please go back and do any items you have skipped.

Scoring Key for the Children's Associative Responding Test (CART)

The correct answers and foil errors are listed below. Any errors which are not foil errors are nonfoil errors. Half of the CART items do not contain foil errors.

Item	Correct	Foils	Item	Correct	Foils
1	5 wolf	1 cat	22	5 granted	--
2	1 lunar	--	23	5 city	3 woman
3	3 weave	1 rug	24	4 desert	1 water
4	5 possess	--	25	4 make	3 sleep
5	4 scratch	2 cat	26	3 why	--
6	2 enemy	1 mad	27	1 snail	5 fast
7	5 garden	4 flowers	28	2 lift	--
8	5 width	--	29	1 occur	--
9	2 speak	--	30	2 above	4 off
10	1 steel	5 soft	31	5 mine	--
11	5 against	--	32	2 success	--
12	3 merchant	4 buy	33	5 spray	2 insect
13	1 exhausted	--	34	1 noise	--
14	5 house	3 girl	35	3 color	1 white
15	4 past	--	36	4 round	2 short
16	4 protected	3 scared	37	4 fish	2 bird
17	2 either	--	38	4 those	--
18	2 explain	--	39	1 ping-pong	4 chair
19	3 robes	1 queen	40	4 cloudy	3 light
20	3 method	--	41	3 original	--
21	4 dark	5 light	42	4 giant	1 short

Item	Correct	Foils	Item	Correct	Foils
43	1 climb	5 low	58	3 then	--
44	3 kick	--	59	5 person	--
45	5 thief	--	60	4 chalk	5 black
46	5 sing	1 happy	61	5 sum	2 subtract
47	1 nail	--	62	1 refuse	--
48	2 string	3 cut	63	4 food	1 me
49	4 author	--	64	2 mood	4 happy
50	2 runner	5 fast	65	3 seldom	--
51	4 doctor	--	66	3 luxury	--
52	3 nuts	--	67	5 neglect	--
53	5 stairs	2 down	68	2 gain	--
54	5 one	--			
55	1 lips	--			
56	3 peasant	2 house			
57	1 baby	4 man			

The CART and its scoring key were obtained through the courtesy of Thomas M. Achenbach, Ph.D.

DIRECTIONS FOR MATCHING FAMILIAR FIGURES

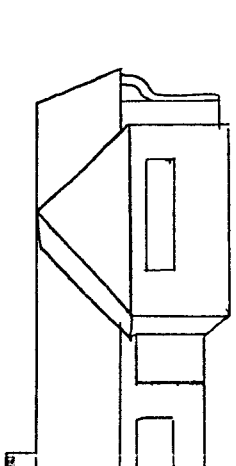
"I am going to show you a picture of something you know and then some pictures that look like it. You will have to point to the picture on this bottom page (point) that is just like the one on this top page (point). Let's do some for practice." E shows practice items and helps the child to find the correct answer. "Now we are going to do some that are a little bit harder. You will see a picture on top and six pictures on the bottom. Find the one that is just like the one on top and point to it."

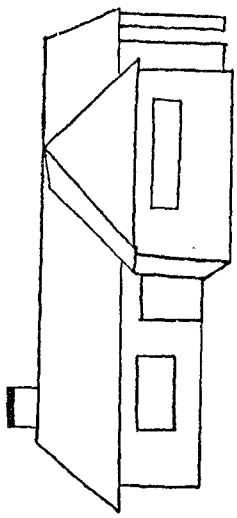
E will record latency to first response to the half-second, total number of errors for each item and the order in which the errors are made. If S is correct, E will praise. If wrong, E will say, "No, that is not the right one. Find the one that is just like this one (point)." Continue to code responses (not times) until child makes a maximum of six errors or gets the item correct. If incorrect, E will show the right answer.

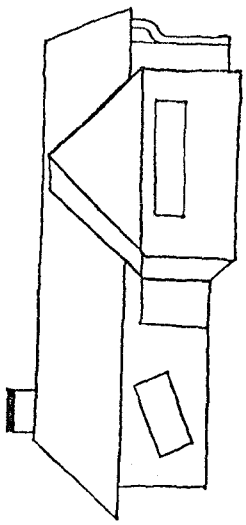
It is necessary to have a stand to place the test booklet on so that both the stimulus and the alternatives are clearly visible to the S at the same time. The two pages should be practically at right angles to one another.
Note: It is desirable to enclose each page in clear plastic in order to keep the pages clean.

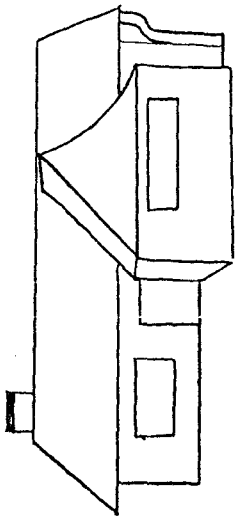
Example of Items from the Matching Familiar Figures Test

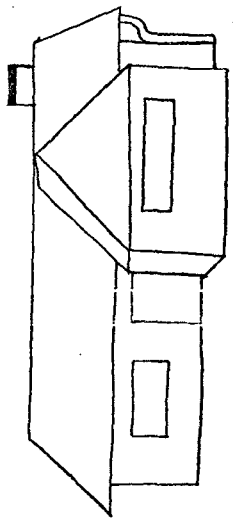
The example presented on the two following pages is not actual size. The size has been reduced to conform to the margins of the dissertation.

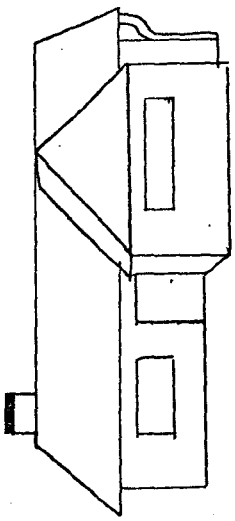


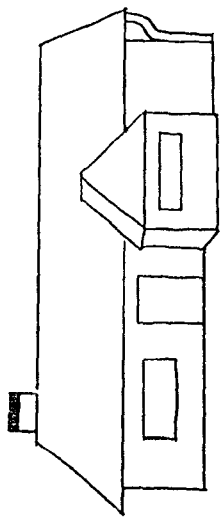












Practice Problem 1

Instructions and Corresponding Questions and Answers

The child was presented with a card (problem card) which depicted 4 boxes arranged to resemble a 2x2 table. The boxes were numbered 1, 2, 3, and 4 with box #2 colored red. The subject was told that the examiner was thinking of one of the boxes, and it was his job to figure out which one it was.

	Questions	Answers
1.	Is it in the top half?	No
2.	Is it #1?	No
3.	Is it colored red?	No
4.	Is it in the left half?	No
5.	Is it #3?	No

Practice Problem 2

Instructions and Corresponding Questions and Answers

The subject was presented with a card which depicted two squares and two circles, one of which was red and the other was black. The subject was told that the examiner was thinking of one of the figures, and he was to figure out which one it was.

	Questions	Answers
1.	Is it a red square or a black square?	No
2.	Is it a black square?	No
3.	Is it a red square?	No
4.	Is it a black circle or a black square?	No
5.	Is it a black circle?	No

Problem 31A

Instructions and Corresponding Questions and Answers

John has 20 horses. There are black race horses and white race horses. There are black farm horses and white farm horses. I want you to figure out how many black farm horses there are?

	Questions	Answers
1.	How many horses does John ride?	1. 10
2.	How many white horses does John have?	2. 7
3.	How many brown horses does John have?	3. 0
4.	How many white racing horses does John have?	4. 5
5.	How many black racing horses does John have?	5. 5
6.	How many brown racing horses does John have?	6. 0
7.	How many white farm horses does John have?	7. 2
8.	How many brown farm horses does John have?	8. 0
9.	How many horses did John sell?	9. 0
10.	How many ponies does John have?	10. 0

Problem 31B

Instructions and Corresponding Questions and Answers

We have 50 objects called C. There are two kinds of C's, one kind is called B, the other kind is called G. Any B can be either an R or a T, and any G can be either an R or a T. No B can be a G and no R can be a T. Will you find out how many of the G objects are also called T?

Questions	Answers
1. How many K's are there?	1. 11
2. How many R objects are also called G?	2. 15
3. How many T objects are also called B?	3. 10
4. How many N objects are there?	4. 10
5. How much is K times C?	5. 550
6. Are there more G than B objects?	6. No
7. How many R objects are there?	7. 35
8. Are there more R objects than T objects?	8. Yes
9. Are there any objects called M?	9. No
10. How many R objects are also called B?	10. 20

Scoring System for Tactics on Problems 31A and 31B and Examples

The sequence of questions selected (tactic) for Problems 31A and 31B are scored in the same way so the questions for problem 31B are contained in parentheses.

1. If question 2 (question 7 for 31B) occurs anywhere in the sequence, assign a weight of .714.
2. a. If question 5 (3 for 31B) occurs after question 2 (7 for 31B), assign a weight of .286.
   b. If question 5 (3 for 31B) occurs before or without question 2 (7 for 31B), assign a weight of .143.
3. a. If questions 4 or 7 (2 and 10 for 31B) occur without question 2 (7 for 31B), <u>each</u> is assigned a weight of .286.
   b. If questions 4 or 7 (2 and 10 for 31B) occur with question 2(7 for 31B), <u>each</u> is considered redundant; and <u>each</u> is assigned a negative weight, -.125.
4. Questions 1, 3, 6, 8, 9, and 10 (1, 4, 5, 6, 8, 9 for 31B) are irrelevant; and <u>each</u> is assigned a negative weight, -.167.

Examples of Scoring for Problems 31A

Tactic	Scoring
2, 5	.714 + .286 = 1.000
5, 2	.143 + .714 = .857
4, 7, 5	.286 + .286 + .143 = .715
4, 2, 6, 5	-.125 + .714 -.167 + .286 = .708

CODE NUMBER_____

	YOU AND SCHOOL	YES	NO
1.	Do your marks get worse when you don't work hard?	(*)	( )
2.	Does studying before a test seem to help you get a higher score?	(*)	( )
3.	Are you surprised when you get a good mark?	( )	(*)
4.	Do you think studying for tests is a waste of time?	( )	(*)
5.	If you get a bad mark, do you feel it's your fault?	(*)	( )
6.	Are you surprised when the teacher says you've done an assignment well?	( )	(*)
7.	When a teacher gives you a low mark is it because she doesn't like you?	( )	(*)
8.	When you really want a better mark than usual can you get it?	(*)	( )
9.	Do you think students get low marks just because luck is against them?	( )	(*)
10.	Do your lowest grades come when you don't study your assignment?	(*)	( )
11.	Do your test marks seem to go up when you study?	(*)	( )
12.	Is a high mark just a matter of "luck" for you?	( )	(*)
13.	Do you think you deserve the marks you get?	(*)	( )
14.	Do you usually get low marks even when you study hard?	( )	(*)
15.	Are tests just a lot of guesswork for you?	( )	(*)

Note. An asterisk indicates the response which reflects belief in internal control.

Scale to Assess Expectancy of Success, Attainment Value, and Minimal Goal Level in Reading and in Arithmetic

1. Circle the grade below which shows the grade you <u>really</u> expect to get in reading on your next report card.

   E Excellent
   G Good
   F Fair
   U Unsatisfactory

2. Circle the grade below which shows the grade you <u>really</u> expect to get in arithmetic on your next report card.

   E Excellent
   G Good
   F Fair
   U Unsatisfactory

3. How important is it to <u>you</u> to do well in reading.

   1 2 3 4 5 6 7 8 9 10
   Not very important Very important

4. How important is it to <u>you</u> to do well in arithmetic.

   1 2 3 4 5 6 7 8 9 10
   Not very important Very important

5. Circle the grade below which shows the lowest grade you could get in reading and still be satisfied.

   E Excellent
   G Good
   F Fair
   U Unsatisfactory

6. Circle the grade below which shows the lowest grade you could get in arithmetic and still be satisfied.

   E Excellent
   G Good
   F Fair
   U Unsatisfactory

APPROVAL SHEET

The dissertation submitted by Allan N. Kaczala has been read and approved by the following Committee:

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Dr. Jeanne M. Foley
Associate Professor, Psychology and
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Dr. John Shack
Associate Professor, Psychology, Loyola

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

1 September 1973 — Date

Patricia M Barger PhD — Advisor's Signature